SKYWAYS

MILITARY ★ CIVIL ★ COMMERCIAL AVIATION

Illinois U Library

JET for Lightplanes

page 22

ouglas A2D . . . Air Navy's
ew Turbo-Prop Skyshark

page 10

lot's Report: Piper PA-18 . . . p

9K-4BS 12-50
CHICAGO UNDERGRADUATE
DIVISION
NAVY PIER
CHICAGO 11 ILL

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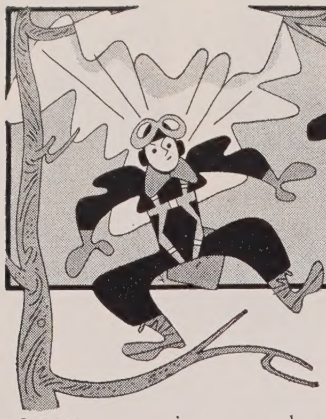


The Birdmen's Perch

OKAY—so you've got to land someplace!

We've told you lots of ways to avoid emergency landings, but let's assume you're coming down anyway.

Here are a couple of pointers that may write a happy ending to a very tight little situation:

1. If you've got any choice at all, pick a big hunk of clear space, even though the terrain may be rougher than that little parking lot across the road. A smooth surface doesn't help much when there's not enough of it to slow down in.

2. Be sure to land into the wind and, above all, to maintain your flying speed.

3. If you're heading into the shrubbery and it's apparent that you can't stop, aim the nose of your ship between a couple of trees so that the wings (not the fuselage) will absorb most of the shock.

Now let's see—two prize sycamore trees at $75.00 each; one section of wire fence, $30.00; one . . .

AND HERE'S ANOTHER TIP!

Now that you're up and around again, and contemplating a bit of flying—

Don't get caught with your oil pressure down!

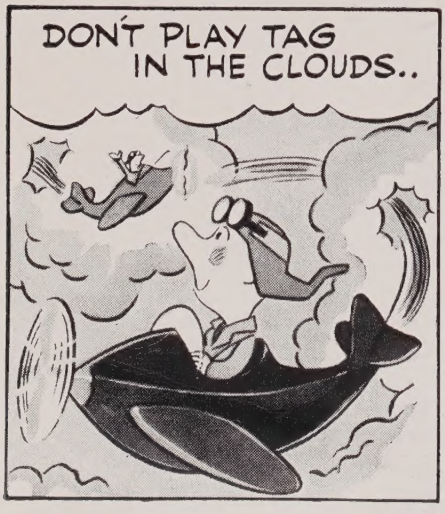
There's nothing, positively nothing that will keep that little old engine happy like a crankcase full of Gulfpride Aviation Oil—Series D!

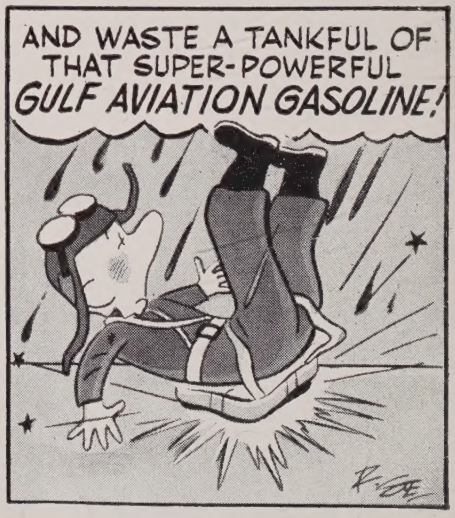
Ask any piston! It's the finest detergent dispersant oil there is for horizontally opposed engines—the only aviation oil put through Gulf's exclusive Alchlor process to remove those extra carbon and sludge formers!

Try Gulfpride Aviation Oil—Series D—the very next time you fly. Increase those periods between overhauls up to 100%.

GULF

AVIATION PRODUCTS





Gulf Oil Corporation . . . Gulf Refining Company

More freedom for business action-
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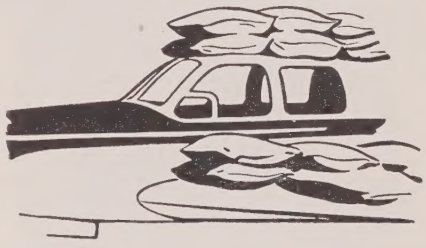
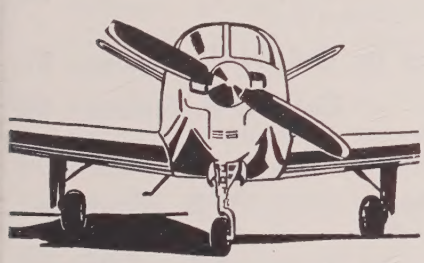
Beechcraft

You make more calls when you cruise at a 170-mile clip. No wasted time, no wasted effort. Travel *means* more! Minutes in the air pay you back with hours of productive time.

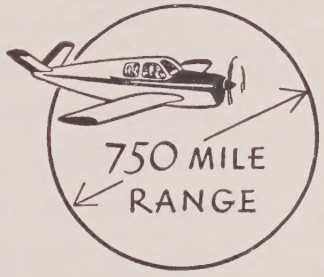
You get to *where* the business is in luxurious comfort. Room to spare for four big people in the smartly tailored, quiet Beechcraft Bonanza cabin. Maximum 5-way visibility.



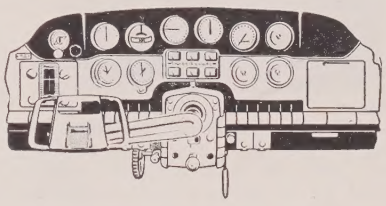
You travel in safety. The B35 Beechcraft Bonanza is extra rugged, withstanding shock and stress tests far surpassing CAA requirements. All-metal construction.



You get top performance. Flight characteristics make it exceptionally easy to handle. Speed, range and fuel economy unexcelled! Wide, sturdy landing gear smooths out short, rough-field landings.



You get amazing efficiency. At cruising, the Beechcraft Bonanza uses only 56% of the engine's rated take-off horsepower! And fuel consumption is low—amounting to only 9.5 gallons per hour!



You enjoy many extra features. For instance, a functionally designed instrument panel, highly efficient . . . but handsome, too! Touches of luxurious comfort everywhere—even to coat hangers, ash trays, map pockets!

Get all the facts! There are hundreds more . . . about the extra advantages of the new Model B35 Beechcraft Bonanza. Check with your nearest Beechcraft distributor or dealer, or write for complete information on your company letterhead to Beech Aircraft Corporation, Wichita, Kansas, U.S.A.

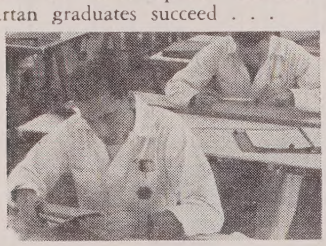
Top speed, 184 mph
Cruising speed, 170 mph
Range, 750 miles
Fuel economy, 9.5 gph

Beechcraft
BONANZA

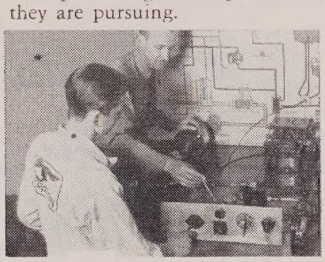
BEECHCRAFTS ARE THE AIR FLEET OF AMERICAN BUSINESS

Vol. 9, No. 10, October, 1950, SKYWAYS is published monthly by J. Fred Henry Publications, Inc., 444 Madison Ave., New York 22, N. Y. Printed in U. S. A. Single copy 25 cents. Subscription Prices: U. S., possessions, Canada and Pan-Am. Union, $7.00 for three years, $5.00 for two years, $3.00 for one year; all other countries add $1.50 per year for postage. Six weeks required for address changes (give both old and new address). Manuscripts, drawings, other material must be accompanied by stamped, self-addressed envelope. SKYWAYS is not responsible for unsolicited materials. Reentered as second-class matter April 16, 1948, at the post office at New York, N. Y., under the act of March 3, 1879. Copyright 1950 by J. Fred Henry Publications, Inc.

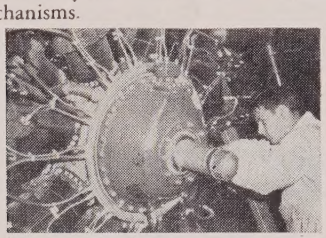
There are three special reasons why Spartan graduates succeed . . .



1. Spartan students study the best, up-to-date texts pertaining to the phase of aviation they are pursuing.



2. Huge charts, mockups and working models are used so students may see and study the actual operation of power plants, hydraulic systems and other complicated mechanisms.



3. Students perform the actual tasks which impress the actual operation so firmly on the mind, it will not be forgotten. Find out how you can prepare yourself for a well-paid job in aviation . . . a job that offers a permanent future.

Write for Details of the Spartan Omni Navigation Course

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SKYWAYS

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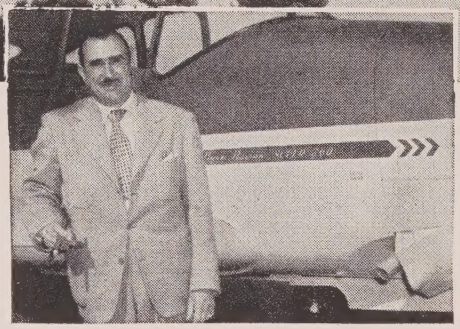
The following publications are combined with SKYWAYS: Air News and Flying Sportsman. All rights to these names are reserved by J. Fred Henry Publications, Inc.

"MOST TERRIFIC AIRPLANE I'VE EVER FLOWN"

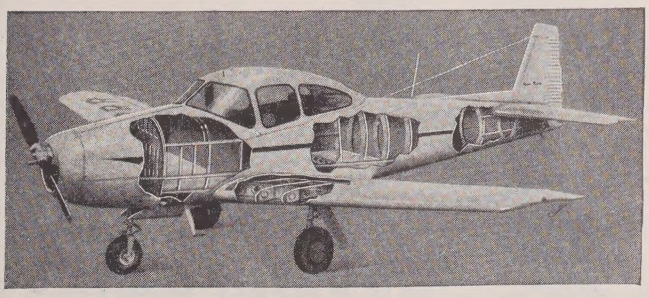
says* PAUL MANTZ, *famed inter-city speed and movie pilot, 3-time Bendix Trophy Race winner



"Ryan's way out front this year with the *Navion* Super 260!," continues Mr. Mantz, "I've never seen anything like it in my life. Ten minutes to 10,000 feet! That gives you an idea of its phenomenal performance. It's big and powerful . . . it cruises at 170 mph, yet lands at a sensationally slow 55 mph with *full load* and *no wind*. In every way it beats everything I've ever flown. It has both maximum performance and maximum safety. Anyone can fly it easily and safely. Its high altitude performance is amazing. Soundproofing, ventilation, the radio, interior appointments . . . everything is perfect. And that sweet-running 260 h.p. Lycoming engine! It drives the new Hi-Cruise propeller through silent reduction gearing at low RPMs for maximum efficiency and reduced noise level.

"The Super *Navion* is as outstanding in its class as the P-51 Mustang is among piston-engine fighters. And no wonder! They're both products of real engineering leadership. With its 1250 fpm rate of climb, fast cruise and 18,000 foot ceiling, the Super *Navion* has the same 'get up and go' I like so much in my P-51s. It gets off like a scared jackrabbit in just 400 feet . . . in 770 feet I was over a 50-foot obstacle with *full load* and *no wind*. And I found all this in a big, roomy, strong, full-sized he-man airplane that justifies the greatest ease of mind. Only in the Ryan Super *Navion* can you find this wonderful combination.

"Never before has there been a plane of such quality . . . such outstanding performance in *every* way . . . a plane so thoroughly reliable and serviceable. To combine all that in full measure is a master accomplishment."



RUGGED, DEPENDABLE Pound *Navion's* rhino-thick skin with your fist...examine those sturdy "built-like-a-bridge" wings...compare that husky landing gear. Give it a mauling hard ride on roughest ground!

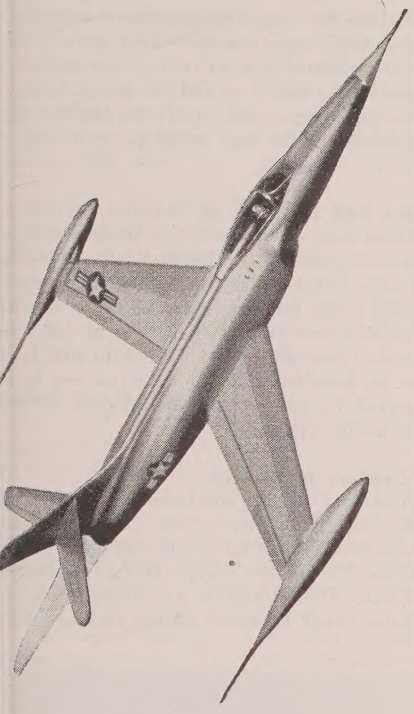
Ryan Navion

NO OTHER PLANE COMBINES SO MANY FEATURES SO WELL

Rely on Ryan RYAN AERONAUTICAL COMPANY, 210 LINDBERGH FIELD, SAN DIEGO, CALIFORNIA

WHAT TIME IS DEFENSE?...

LOCKHEED F-90



Defense Is All the Time

A great airplane is more than swept-back wings and a Mach number.

It is a product of plans and planning... of vision and action... of ingenuity and skill.

It begins with America's determination to remain free. This ideal, forever foremost, requires a vigilance, forever active. It inspires our Air Force to constant research and planning. It stimulates American industry to unmatched invention. And it draws from free American labor vastly superior skills and energies.

But, above all, a great airplane is the product of time—time in research, time in planning, time in designing, developing and building. You can't put time in moth balls, nor buy it back from surplus. Today's new planes were yesterday's plans. Tomorrow's Air Force is being planned today.

Defense is a constant challenge, efficiently accepted and dynamically answered by the U. S. Air Force. The Lockheed F-90 Jet Penetration Fighter, ready for production today, is the product of planning that began more than five years ago.

LOCKHEED

Aircraft Corporation, Burbank, California

Look to Lockheed for Leadership in Jets

AIR YOUR VIEWS

Let's Quit Griping

Gentlemen:

Can't help writing you and complimenting you on the article by Mike Jense titled "Let's Quit Griping." This is just the sort of article I have felt like writing so often myself.

With the splendid airplanes we have available today at reasonable prices, with their fine cruising speeds and cruising ranges, the ease of flying combined with safe flight characteristics and low maintenance costs, the good airports we have conveniently located over the country and the most efficient and helpful CAA Airways Radio stations at our disposal, plus efficient radios, just what on earth do these crack-pots who are kicking private aviation and the use of personal planes want anyway?

My interest in aviation goes back quite a ways. I am now 35 and have been piloting for just a year. My business keeps me tied up and makes it almost impossible for me to be away for long periods of time. In fact, last year I had one day away from my business. Now, with the use of a Piper *Clipper*, my family and I are visiting relatives and friends over week ends and having week-end vacations now and then that are really enjoyable, and there's none of that tiresome, hard driving in the car. I have made trips to the New England states and back with valuable pieces of merchandise, all in the same day. I go to my suppliers at my convenience and see all the latest items where they have them on display. By taking just Saturday off now and then, I am able to see many of the great sporting events in this section of the country, and do so in relaxed comfort and at minimum expense, always for less than driving my own car which is one of the "low-priced three."

In my own experience, I find that in practically every case, I can do much better on trips of 200 miles or more with the *Clipper* than by car so far as expense and convenience is concerned. I don't mean that I do not miss having a car at the other end of the trip, but the speed and ease with which the trip is made more than makes up for that.

It certainly is a shame that nothing can be done to stop people from making false claims like the party is doing who says he will market that $2500 three-place job which will cruise at 150. His cost engineering data will put the lie to those claims if he intends to make any profit and pay his help. This really hurts private flying, for many potential flyers are waiting in vain for such a plane instead of flying one of the splendid, safe planes available right now.

GEORGE M. SAGER

Williamsburg, Va.

Amen, Mr. Sager. You and Mike Jense both are so right. Thanks for your fine letter.—ED.

Traffic Control Lights

Gentlemen:

We couldn't help but notice an error in "Seth's Safety Quiz," question 1, regarding air traffic control light signals. It is noted that the answer as given on page 40 is "taxi back to the hangar line."

According to our most recent issue of "Flight Information Manual," Vol. 4 No. 2, the correct answer to the question should be "taxi clear of landing area (runway) in use."

C. R. BOUGHTON

Bakersfield, Calif.

Apparently Seth Warner has the same manual we had. At any rate, we wrote him and here's his reply: "I wuz wrong! Latest dope as per Boughton letter. The action listed in the July 'Safety Quiz' was obsolete. Latest directive sez' 'Taxi clear of landing area in use.' Sorry about this bobble." (signed) Seth.—ED.

Airphibian

Gentlemen:

Allow me to say that L. M. Horton's article on the *Airphibian* has packed a tremendous wallop on us "ground-doomed" enthusiasts. His version of that particular car-plane has opened a new ray of hope in people like myself who've always wanted to fly, but due to circumstances, couldn't.

Your magazine has opened a new outlet for us. How's about following through and keeping us posted on *Airphibian* production.

ART ARMIJO

Los Angeles, Calif.

The Airphibian *really is a new experience in flying and owning an airplane. We think there'll be a lot of them in the skyways and on the highways soon.*—ED.

Navy XF5U

Gentlemen:

Could you give me any information on the Navy's airplane called the XF5U.

J. C. TUREL

Aberdeen, Wash.

The XF5U never became a production airplane In fact only one full-scale plane of the XF5U type was ever built by Chance Vought and it never flew. A 3,000-pound scale model [V-173] made its last test flight in 1947 and is now in the Smithsonian Institution.—ED.

Wheel Landings

Gentlemen:

I suggest F. H. Schaad of Orland, California write to the Ercoupe outfit at Riverdale, Md., and get the low-down on this wheel landing biz. He's all wet!

Then, that "CD-3 landing" info by J. H. Thomas . . . . . Brother! Wheel landing on short or rough runways? I'm sure glad he wasn't my instructor.

First, when the Ercoupe's on the ground, the wings have a slight negative angle of attack. This angle is even lowered when there is weight in the cabin. So why lower it farther by using down elevator which also induces drag and actually slows up the take-off run. Besides the ship is all ready in a tail-up take-off position normally. As further proof, I've watched an Ercoupe ride out a 60-mph wind, with the brakes on and untied, while other ship's blew away, breaking half-inch tie-down ropes. The book says for short take-off, keep wheel back.

I've seen pilots start a take-off with an Ercoupe and then slam the wheel forward to compress the strut and bounce the nose up so as to get a greater angle of attack on the wings at the slower speed for shorter take-off. This is to overcome the restricted elevator travel and is against all the principles of the Ercoupe design. It's hard on the nose gear and tire even when practiced on smooth runways. The ship staggers into the air a little sooner, but shows poor judgment on the part of a pilot if he continues to repeat the maneuver.

While running take-off and landing tests for the Safe Land Device, the writer used a steel measuring tape. Over 300 take-offs and landings were all measured with all types of lightplanes. From actual measurement, the Ercoupe did not get off quicker by holding the wheel forward, regardless of nose tire size. And the shortest landings were not wheel landings!

FRANK PEARSON

Collingswood, N. J.

MILITARY AVIATION

New Thunderjet

The YF-96A, latest version of the F-84 *Thunderjet*, recently made its first flight at Edwards AFB, Muroc, California. Offering improved speed, range and altitude performance, the YF-96A is powered by a J-35 Allison turbo-jet engine. This new model was engineered, built and flown in just under six months.

Gas-Turbine Prop

An eight-bladed prop for use on high-powered gas-turbine engines developing more than 5,000 hp has been developed by Hamilton Standard. This combination of gas turbine engine and prop will deliver two to three times the thrust of most powerful turbo-jet engine in production today. New prop is actually two four-bladed props, one placed in front of the other on a dual shaft, and geared to turn in opposite directions.

F-94 Delivery

Brigadier General Wm. M. Morgan, vice commander of Western Air Defense Command, USAF, recently took delivery of the first all-weather jet fighters capable of round-the-clock defense of America. The new F-94 intercepter is designed to fly and fight in pitch darkness and under weather conditions that would ground other standard jet fighters. It is built by Lockheed.

Korean Cause

The Air Force has called upon the aircraft industry for aid in developing a fighter-bomber capable of close ground support. Design specs call for turbo-prop engine plane with speed of 500 mph, 45,000-foot ceiling and 2500-mile range. Sweptback wing version of Douglas A2D could meet these requirements. This "new interest" of the USAF in close ground support planes is direct result of bad showing in Korean fracas.

Navy Order

A substantial new production order for Martin P5M-1 anti-submarine flying boats has been placed by the U. S. Navy. The P5M Martin is the first postwar twin-engine flying boat to be developed for the Navy. It is powered by two Wright 3350 engines, and carries crew of seven.

R4D Modernized

One hundred of the Navy's service-worn R4D twin-engine transports are being modernized into military versions of the new Douglas Super DC-3, Navy BuAer recently announced.

R4D is the Navy's designation for the DC-3 and C-47 type transport which gained fame during World War II as the "workhorse" air carrier for the U. S. and her allies. Intended design changes will double the R4D's range, raise its useful load by 50 per cent and increase its speed.

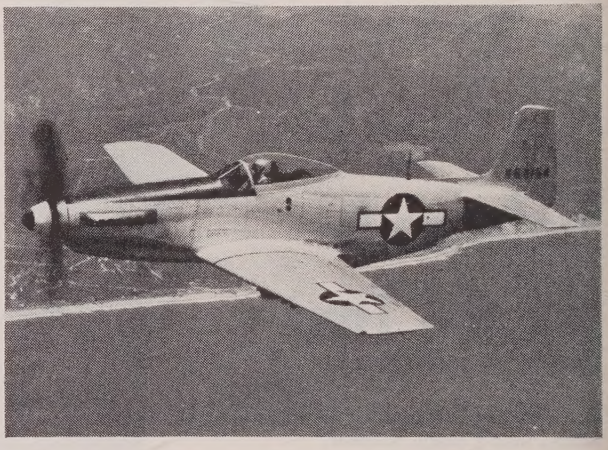
Jet Pod DC-6

Plans have been drawn by Douglas for jet-pod versions of the DC-6. With a Westinghouse J-34 auxiliary turbo-jet engine under each wing, cruising speed of the plane will be increased from 300 mph to at least 400 mph. Plans also call for wing-tip fuel tanks to be installed. This Douglas project is expected to interest military officials as well as airline operators.

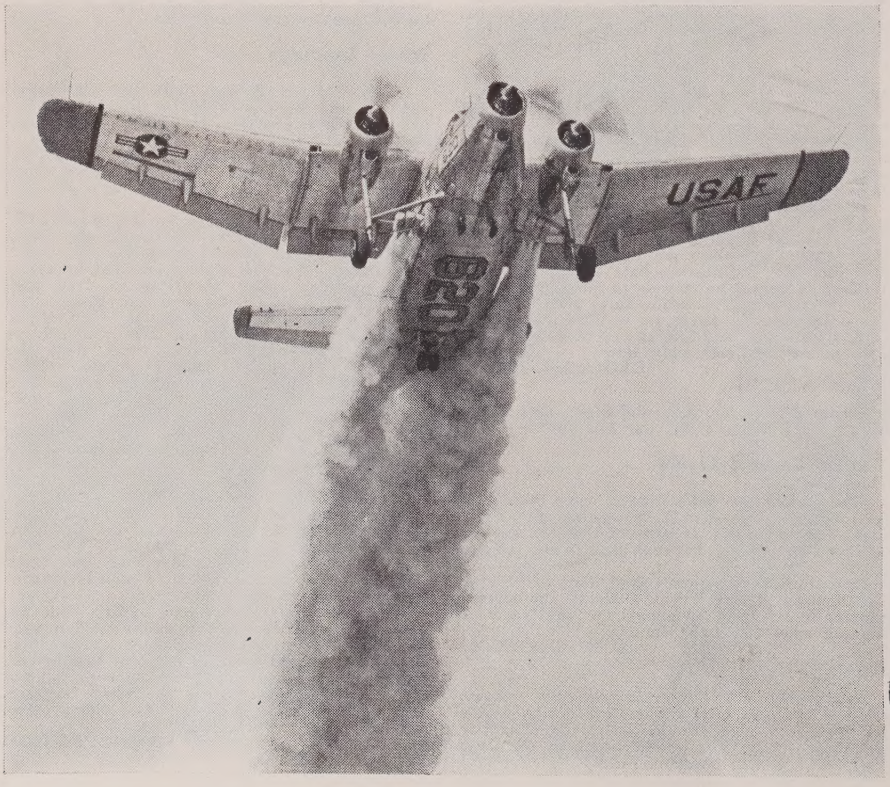
'Copters in Service

According to a mid-summer report from Korean front, only a few helicopters have seen service thus far in the conflict: Sikorsky HO3S-1's for the Navy; H-5's for the Air Force. The HO3S-1's are being used for liaison work between carriers, and for rescue.

AIR FORCE F-51 *Mustang* has gone back into active service as a ground support fighter in the Korean conflict. According to one report, it replaces jets



JATO gets a Northrop C-125 *Raider* up in a jack rabbit take-off. With six JATO units, the C-125 can get off in less than 500 feet. Note the JATO units



Industry Notes

LOCKHEED reports aircraft sales during first six months of 1950 were 50 per cent higher than same period last year.

HILLER Helicopters announces a working production backlog of four hundred thousand dollars of civilian and military orders for the new 1950 Hiller 360 'copter.

TEMCO has been awarded a $50,000 contract for fabrication of canvas jet pod covers for the B-36.

CESSNA won recent competition for L planes for Army Field Forces and National Guard. The Cessna L-19-A is all-metal ship powered by 213-hp Continental O-470-11 engine. More than 400 were ordered by contract.

BOEING announces that Col. Paul W. Tibbets, Jr., pilot of the B-29 that dropped the atom bomb on Hiroshima in World War II, has been assigned by the Air Force to direct a service test program to determine operational capabilities of the Boeing B-47 Stratojet.

SPERRY has received production orders for Zero Reader flight instruments to equip the new U. S. Air Force jet fighter, the Northrop F-89.

RIGHT AERONAUTICAL recently received a $4,000,000 order for *Cyclone* 9 engines to power the Navy R4D transports. The new *Cyclone* engine steps up R4D performance, increasing top speed of the plane to 275 mph and lifting cruising speed to 188 mph.

APITAL AIRLINES placed the first domestic airliner in the service of the Pacific Cliff recently. Employees worked round-the-clock to ready the four-engined cargo plane for its duty across the Pacific. Fuel capacity was increased, and radio equipment was altered for long-range purposes.

idget Jet Engine

A new small inexpensive jet engine that can power guided missiles and helicopters has been developed at the Cornell Aeronautical Laboratory, Buffalo. Called a valveless pulsejet, the unit is a modification of the engine that powered the German V-1. The new engine is substantially little more than a tube with a closed end and a side opening for fuel and air injection. Head of the propulsion laboratory credited with the development of this midget jet is Dr. Joseph Foa. The engine itself was developed by Joseph G. Logan, Jr., research physicist at the laboratory.

ew Designations

The Air Force has announced the re-designation of three new fighters and a bomber. The swept-back-wing Republic YF-96A jet fighter has been renamed the F-84F; the North American F-95A, with radar in the nose, goes back to its original designation F-86D; Lockheed F-97 night fighter powered by J-48 with afterburner, is now the F-94C. Boeing's four-jet B-47 that was redesignated the YB-56A goes back to B-47C.

ar Contracts

The Air Force recently listed the names of the 14 major prime contractors who received the bulk of the new plane and engine orders. These are: Bell Airplane Corp., Boeing Airplane Co., Consolidated Vultee, Douglas, Fairchild Engine & Airplane Corp., Lockheed, North American Aviation, Inc., Northrop, Piasecki Helicopter Corp., Republic Aviation, United Aircraft, Allison Division of General Motors Corp., General Electric, and Wright Aeronautical.

AF Mech Training

According to a recent announcement, two civilian schools have been awarded contracts totaling $592,000 for training 550 USAF airplane and engine mechanics. These two schools, Spartan School of Aeronautics, Tulsa, Okla., and Cal-Aero Tech, Glendale, Calif., share equally in the contracts and each will train 275 enlisted personnel. Training periods will last 36 weeks.

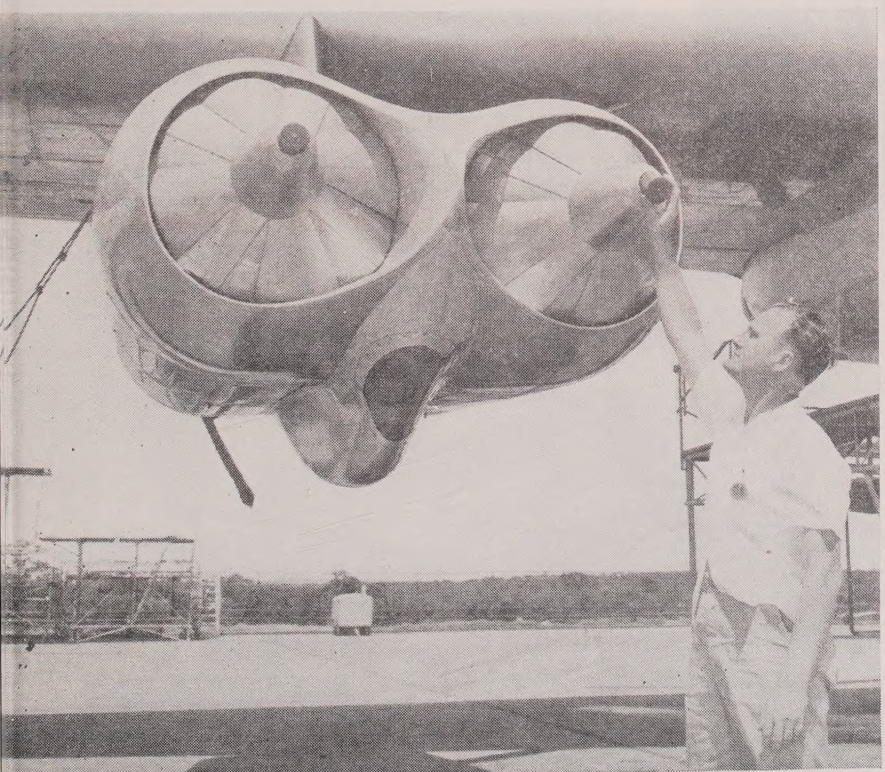
Canadian CF-100

Canada's Department of National Defense has cancelled a proposed non-stop flight of the new Avro CF-100 across the Atlantic to the United Kingdom. Reason given for the cancellation was plans for accelerated aircraft production in Canada. In view of the stepped-up program for increased production, it was considered necessary to keep the CF-100 and a sister fighter in Canada where they will be used to speed the testing of electronic equipment going into the fighters as they come off the production line. The all-weather day-night jet fighter was to have been demonstrated at the Society of British Aircraft Constructors show at Farnborough, England, this month.

National Guard Strengthened

The 27 groups of the Air National Guard are at almost full strength, manpower-wise, and they are 75 per cent of full strength, plane-wise. The ANG has about 2500 planes (some F-84's) and 45,000 officers and men.

ET POD houses the B-36D's jet engines. When jets are not in use, pod's doors are closed



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HIGH SCHOOL ATTENDED Graduated: Yes ☐ No ☐
S-10 Check one: ☐ Veteran ☐ Non-Veteran

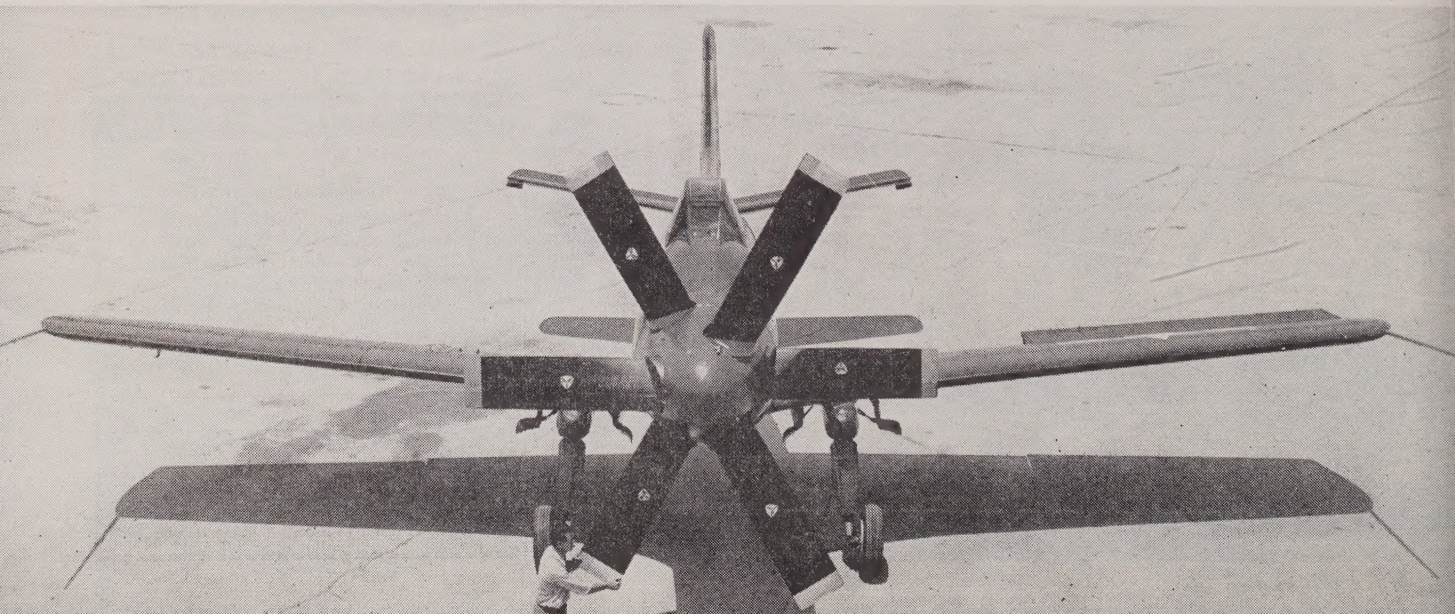
Turbo-Prop *Skyshark*

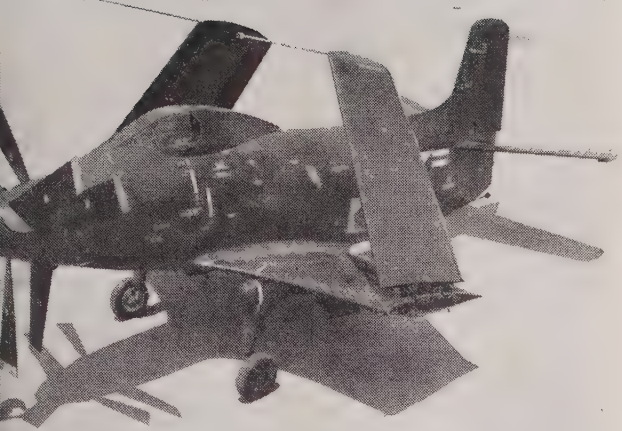
SPEED of the turbo-prop A2D is comparable to that of pure-jet fighters. Its rate of climb, range, are better

By GILBERT C. CLOSE

A2D introduces successful turbo-prop power in military aviation

PROPELLER used on the *Skyshark* is a contra-rotating Aeroproducts. Note flat, broad blades, square prop tips





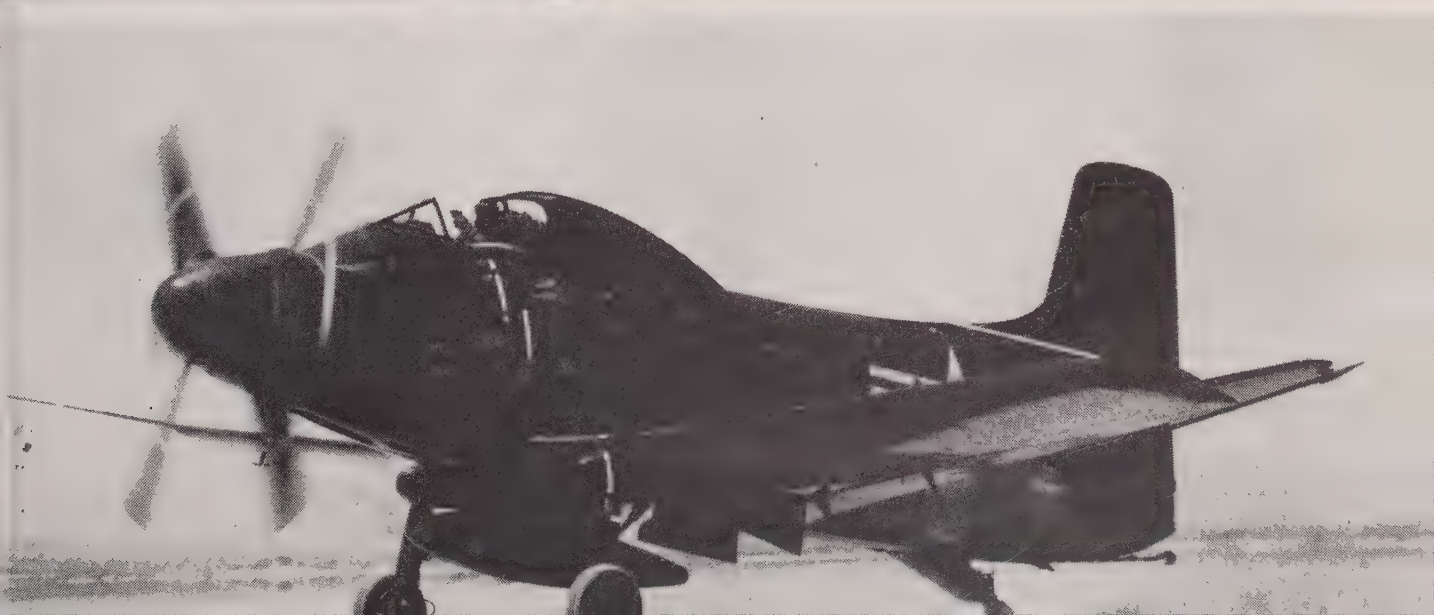
DESIGNED for operation off decks of small carriers, the A2D is equipped with folding wings, arresting hook

ON JUNE 2, 1950, a new airplane spread its wings in the hot, clean air above the Mojave, circled Edwards Air Force Base a few times, then came in to a neat landing. There was nothing unusual about the physical aspects of the flight, but to those in the know, the implications of that flight were tremendous. It was the advent of successful turbo-prop power in U.S. military aviation. The flight lifted one corner of a curtain on what may become a new trend in air-power development. The propeller, seemingly relegated to a museum pedestal when pure jet propulsion entered the picture, was back on the nose of an airplane where it may remain for a long, long time.

The airplane was the new Navy attack bomber, the Douglas-built A2D *Skyshark*. It was powered with the equally new Allison T-40 twin-unit gas turbine engine driving contra-rotating Aeroproducts propellers. The 5500 horsepower crowded in the belly of the little attack bomber was more power than had ever been crowded in an airframe of equal size. Pre-calculated performance figures for the A2D gave it a speed comparable to that of many jet fighter airplanes, and other performance characteristics such as take-off distance, rate of climb, load-carrying ability, and radius of action, far superior to pure jets of similar size and design. Data gathered since that first flight carries out these predictions.

The A2D with its turbine-driven propeller is definitely not a transitional airplane designed as a stop-gap until pure jet propulsion reaches a higher degree of efficiency. The *Skyshark* was designed and built to accomplish (*Continued on page 40*)

POWERPLANT of the fighter is the new Allison T-40 twin-unit gas turbine driving contra-rotating props and delivering 5500 horsepower. This type prop offsets propeller torque and eases A2D's critical carrier deck landings



Read Me the Roadmap

CLOUDS hung off *Navion's* right wing, but as long as the Rand McNally was in the cockpit, navigational matters went all right

By RUDY LIBRA

"We lost again?" I asked the co-pilot sadly.

"Yeh . . . don't know where in 'ell we are—exactly, that is. Read me the road map again," he answered with a half-grin.

Give two ex-Berlin Airlift pilots a new *Navion* to deliver across the country and life suddenly becomes complicated.

We'd both been flying long enough to know better: 5,000-odd hours each in the past 12 or 14 years. But it'd been about eight years since either of us had flown anything smaller than a DC-3.

PILOT Mitchem *(left)* read the road map while the author sweats out a computer. Thanks to map, they made their RON at ETA

"Shucks, this'll be a cinch vacation trip," I had told Stan Mitchem when we set up this delivery flight from the Ryan factory in San Diego to Aviation Consultants in Reading, Pennsylvania. I should have kept my big mouth shut.

Just how wrong can a guy be? If we hadn't brought that road map for the return trip via single-engined Studebaker, we'd have never made it. I'd completely forgotten that compared with these little airplanes—no auto pilot, no radio comp for navigation, no crew chief, no "powder room"—flying a C-54 is a lazy-man's way of going places. But it was interesting to say the least.

I'd suggested to Mitchem and our two passengers that we get an early start and make either Wichita or Kansas City by dark, but that was before we sat up half the night reading the operations manual on the airplane.

At daylight the next morning it was drizzly with a solid overcast at 1500 feet. That's no trouble in a C-54—you just file an instrument clearance and plow up on-top. But Lloyds of London's ferry insurance doesn't cover night or instrument flight in a single-engined airplane. So four sleepy people sat around the San Diego Weather Bureau and bothered the man juggling the isobars.

Finally out of sheer self defense the W.B. called El Cajon on the phone. Yes, El Cajon was contact. Yes, they could see the top of the mountain. Yes, a little airplane might be able to get through underneath.

We thanked the Weather-or-not man, piled into the airplane and taxied out for take-off. After a C-54, the pre-take-off check list for a *Navion* is a cinch, but neither Mitchem (*Continued on page 35*)

CHECK POINT for the wondering and wandering ex-Airlifters was the "iron mike" off right wing. Airport, 9 miles East

BAGGAGE that went into the *Navion* added up to more than duffles. In addition, 50 pounds of freight went aboard

GAS STOP was made at small field at Cuervo. Ship's rugged gear, good get-away nullified poor field conditions

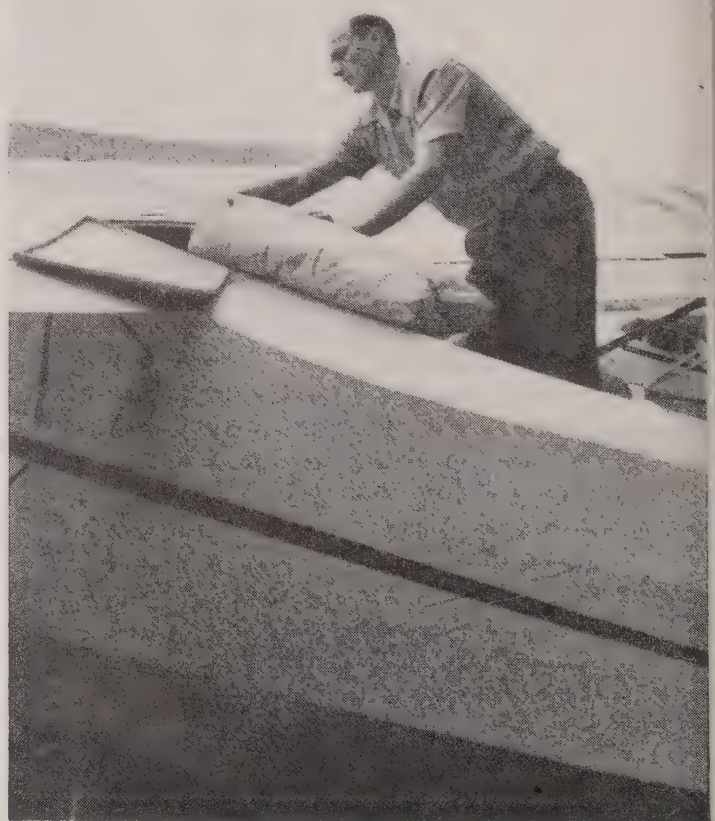
CAA MAN Paul E. Bailey at Cuervo sold the boys two 5-gallon cans of gas, enough to get them to Tucumcari, N. M.

SUPER CUB is available in two versions: trainer and crop duster. Trainer has 90-hp engine; the duster has a 108-hp

TANDEM GEAR permits travel over rough terrain, plowed fields. Front-wheel tire is inflated to 4 pounds, rear to 8 pounds. The gear's brake is on tandem's rear wheel

HOPPER in the "workhorse" Super Cub will carry over 9½ cubic feet of dust. Hopper is built into the ship where the rear seat would be on the standard Super Cub 105

CROP DUSTER version's fan or impeller agitates the dust in a downward direction. Tank for spray is also available



SUPER CUB with tandem gear was taxied and flown in and out of bad field to show off the gear's farm usefulness

NEW PIPER carried dust to emphasize its get-away ability. In demonstration, ship was up and away in 75 feet

Pilot's Report: Piper Super Cub

By H. L. MAY

During the past year, the Pipers have spent time and money researching the aircraft-needs of ranch operators, farmers, pipe and powerline inspectors, lake and stream stockers, dusters, and city and country folk with small backyards. The result of Piper's efforts is one of the most useful lightplanes we've ever seen. . . . the Piper PA-18 *Super Cub.*

Your reporter's introduction to this new model came as the result of an invitation to attend a demonstration of two models of the PA-18.

Everyone attending that demonstration expected to see "just another trainer." But there was plenty more, and it was that "plenty more" that sold us on doing a pilot's report. When an airplane can get off in 75 feet, hover in the 30-mph category, then land again in about 60 feet, Brother, that's an airplane!

There are two versions of the PA-18. One is powered by 90-hp Continental and is designated the *Super Cub* 95; and the other is powered by 108-hp Lycoming engine, and it is designated (*Continued on page 38*)

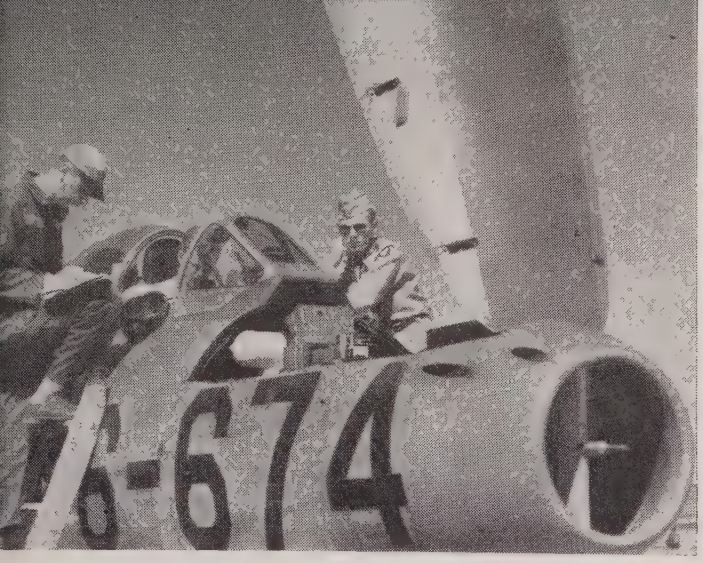
Daniel Boone Was A Piker

By LT. DON STUCK

as told to Don Downie

PILOT-AUTHOR Stuck is based at Langley AFB

AIR FORCE *Thunderjet* (*right*) skip-bombed the target at the Las Vegas gunnery meet, but this one missed. Planes that took part included F-80's, F-84's, F-86's and F-51's



FLIGHT LINE overhaul kept the mechanics busy during the meet. Boys here are working on the gunsights of an F-84

OVERHAUL means work on the guns, too. These crewmen are doing maintenance job on one of the ship's 50-cal. guns

Daniel Boone was on the ball with a smooth bore squirrel rifle.

Robin Hood did it with a bow and arrow.

Today's sharpshooter uses six 50-calibers and sights his gun platform at 450 knots. He may not be able to shoot the right eye from a fly at a hundred yards, but he can certainly knock down the fly—wall and all.

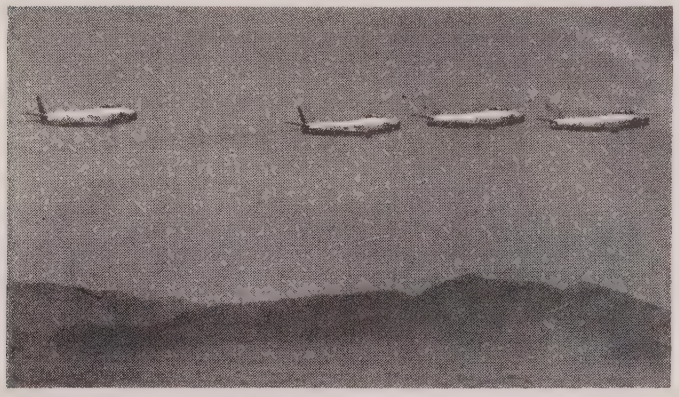
The six 50-caliber machine guns on my F-86 *Sabre* will fire a total of 120 rounds in a one-second burst. From 800 to 1200 feet, they will hold a target with pin-point accuracy. The bullets themselves are lethal for over three miles, but accurate firing is still limited to a quarter of a mile.

There's no short-cut to good air gunnery. First you must learn the correct techniques. Then it's a matter of practice, practice and more practice. You go up and fire a full load (*Continued on next page*)

ARMOR loads the lead (*right*) into Pilot-Author Lt. Don Stuck's F-86 just before his take-off to participate in annual Air Force gunnery meet. The six 50-cal. guns in an F-86 fire a total of 120 rounds in one-second burst

into an aerial tow target at 20,000 feet. Then you land, count the hits in the target and try to analyze your mistakes from the film out of your gun camera.

These towed targets are usually 6 x 30 feet and are trailed 700 feet behind a B-26 or an F-51. Normal tow speed is 190 mph Indicated, 265 mph actual at 20,000 feet. The targets presently in use are made from a plastic material that becomes brittle when it gets cold. Frequently the target will break up after the first few rounds are fired into it. Once I had a



BOSS of the 81st Fighter Interceptor Group, based at Kirtland AFB, is Col. G. Pinkston (*above*). The 4th Fighter Interceptor Group (*left*) is based at Langley Field. Lt. Donald Stuck is flying the number 3 (*from right*) F-86

target pull lose and go right into the engine scoop of the F-86 I was flying at that time. The aircraft kept running and I flew it home, but it took a lot of cleaning to get the pieces of that target out of the jet engine intake.

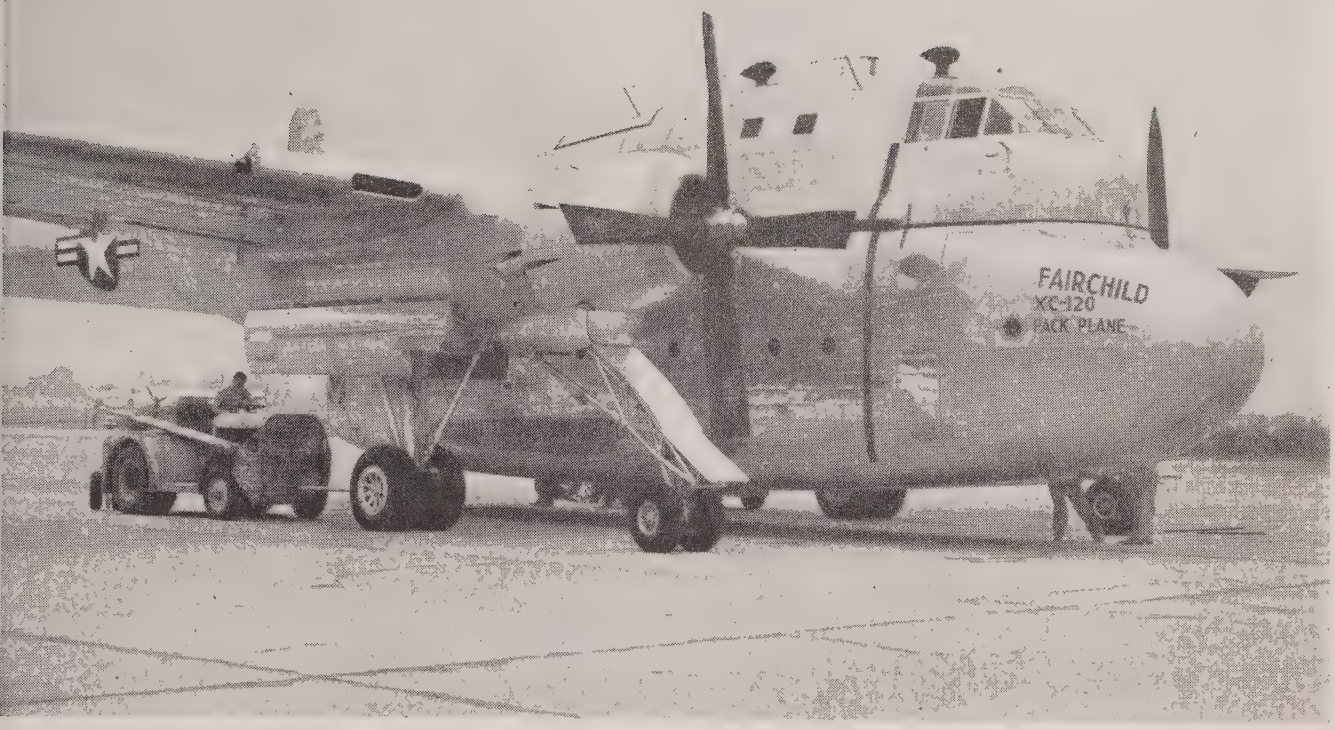
A new rayon material is being developed that will not become brittle when it gets cold. This will mean safer targets that can withstand higher towing speeds.

The breakaway from the target should be made at the same level or above the target. In that way there is less chance of running into a target that has been shot off.

When you're closing in on the target at better than 200 knots and the thing tears loose from the spreader bar and stops dead in the air, your rate of closing suddenly becomes 400 knots and you have only about 500 feet in which to maneuver your aircraft. If you're really "boring in" on the target, it is almost impossible to miss if it breaks loose. Almost a third of the total aerial gunnery accidents in 1949 were caused by running into the target.

Here's how a typical aerial gunnery mission works. All three or four planes will start their engines at the same time. Guns and rockets are loaded, but not charged on the ramp. When you taxi out to the end of the runway before take-off, you park so that the nose of your plane is pointed away from all buildings and populated areas. Then you check all switches on guns and gunsights to make sure they are off. After that final check, you put your hands clear outside the cockpit and the Armorer on the ground charges the guns or connects the rockets. Accurate gunnery is much more than lining up on a target and pulling the trigger. The Air Force gunnery program takes 10 (*Continued on page 43*)

FIGHTERS taking part in the gunnery competition are shown here parked at Las Vegas. Note three F-51's about to take off.



FAIRCHILD XC-120 features a detachable fuselage called "pod." This can be left on ground while plane itself flies

PACK PLANE

A revolutionary new military transport, the Fairchild XC-120 *Pack Plane*, recently began its series of U. S. Air Force tests. Feature of the *Pack Plane* is the detachable fuselage, called "pod," which can be left on the ground for unloading while the plane itself (engines, cockpit, booms and tail surfaces) flies away for another pre-loaded fuselage. In effect, the *Pack Plane* melds the trailer truck principle with the airplane. The advantage of the design is that it eliminates long and expensive periods spent on the ground while the fuselage is being loaded and unloaded. With the Fairchild, a load of cargo can be flown into a field, the ship's "pod" almost instantly detached, and the plane ready to take off to pick up another loaded fuselage within a few minutes. In addition to providing greater utility of the plane itself, the reduced ground time limits the potential damage in case of wartime attack on the relatively inexpensive fuselage.

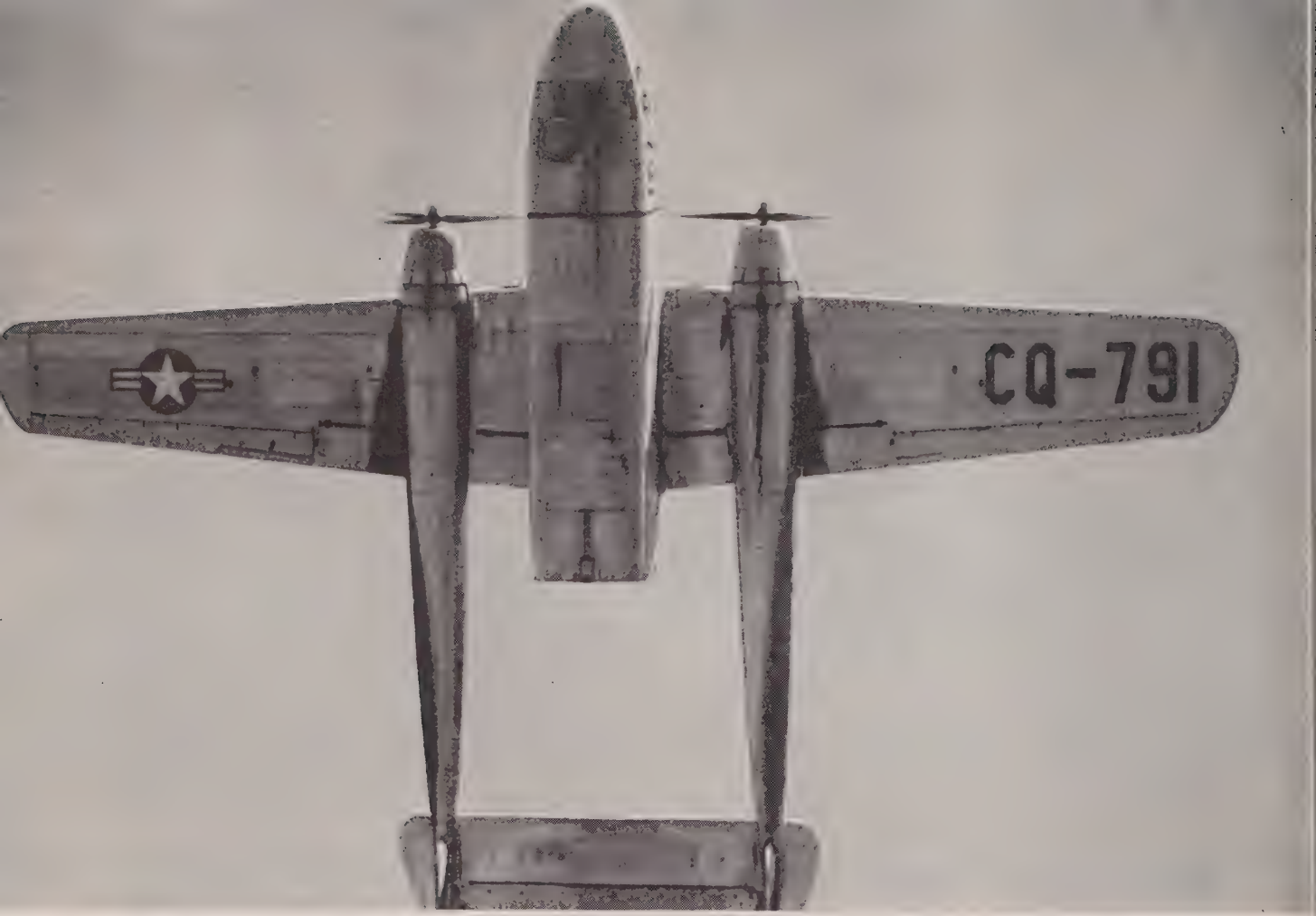
Once on the ground and detached from the plane, the "pod" can be unloaded at the time most convenient for ground crews, then re-loaded and stored until it is ready to be picked up by another XC-120. The fuselage has both front and rear clam doors which permit quick loading of large equipment.

Powered by two 3,250-hp Pratt & Whitney engines, the XC-120 has basically the same operating characteristics as the C-119. The 120's detachable cargo compartment offers a 2700 cubic foot capacity and can carry up to 20,000 pounds of cargo. Fully loaded the entire plane weighs about 64,000 pounds and carries a crew of five.

So that the "pod" can be loaded and rolled away, a new type landing gear was developed. The XC-120 is the first plane ever to have what is called a "quadricycle" gear. The plane itself rolls on four dual-wheeled main gears, two on either side. The two gears on each side retract into nacelles. In addition, the fuselage has four smaller dual-wheeled gears which permit it to be towed and moved away from the plane. When the "pod" is attached, these wheels are removed, stowed in the fuselage.

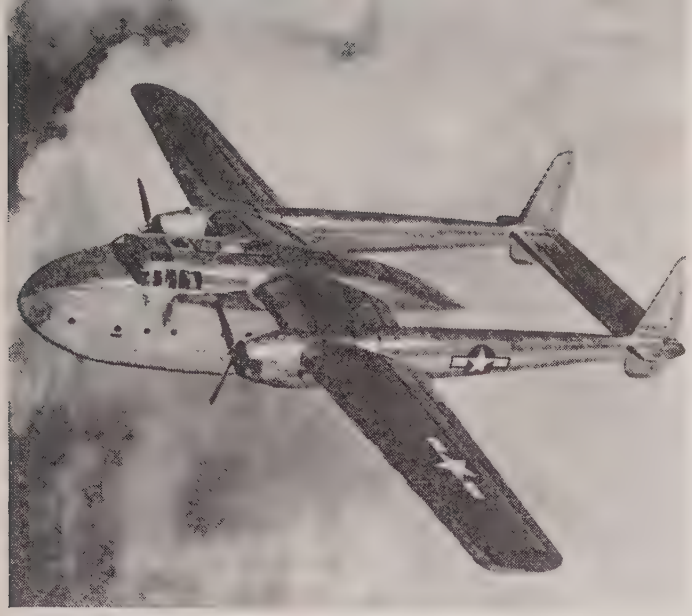
The "pod" is held to the plane by four ball socket connections, the top of the "pod" fitting into the underside of the plane. For raising and lowering the "pod," four electrical cable hoists are used, two on each side of the ship. Cables are attached to four points on the outside of the "pod," which is then lifted or lowered by the plane's four hoist systems. These can be operated simultaneously or separately. To seal the space where the "pod" and plane come together, a rubber tubing stretches around the entire top edge of the "pod." Air pumped in expands it to provide a tight connection.

No XC-120 production plans have as yet been announced.



AIR FORCE *Packet* with its great capacity was tailor-made for operations like the Airlift. Note radar "tub" aft of nose

Packet Passage



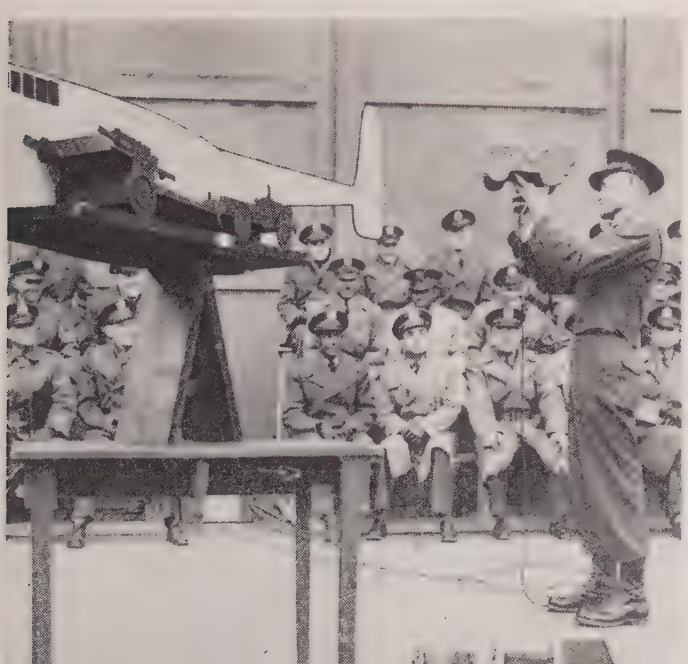
PACKET in service now in Germany is the C-82. Latest version coming off Fairchild production lines is the C-119

Troop Carrier Wing based in Germany could start hauling help in a hurry

By ALBERT S. BURCHARD

"You want to know how long it would take to get a Berlin Airlift started again? Well, I'll tell you. If the phone rang right now and the old man said start flying things to Berlin, I'd say if somebody would lay down the stuff here on the field right now, we'd fly it in right now. It would take just that long."

TROOP CARRIER boys work closely with ground forces in European Command. At Air Transportability School, flyers and infantrymen join forces to learn how to handle the *Packet*, how to load it, how to move men, equipment



That's what Brig. Gen. Edward H. Alexander had to say, and he's the man whose business it is to know. Gen. Alexander is the commanding general of the 61st Troop Carrier Wing, including their air base, just outside Frankfurt, Germany. And the 61st Troop Carrier Wing is the outfit that would start deliveries.

Alexander, who commanded the 1st Airlift Task Force after Maj. Gen. William H. Tunner went home, hastened to add that the efforts of his wing would be only a beginning. The general, a tall, lean man with a leathery face and sharp, hooded eyes added:

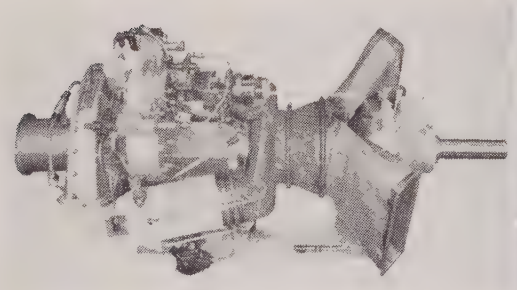
"To get it built back to peak strength—well, I don't know. I estimate it would take from 50 to 60 per cent of the time it took before. Last time we made mistakes and false moves. We'd never done it before, and neither had anyone else. For instance, we had to get a bunch of C-47's out of the way, not only out of the air but (*Continued on page 41*)

JET for Lightplanes

By
JERRY LEMELSON

Pro's and con's of jet as lightplane power source

BOEING turbo-jet engine *(right)* produces 150 pounds thrust, weighs 85 pounds. Turbo-prop engine *(below)* produces 200 shp, weighs 140 pounds

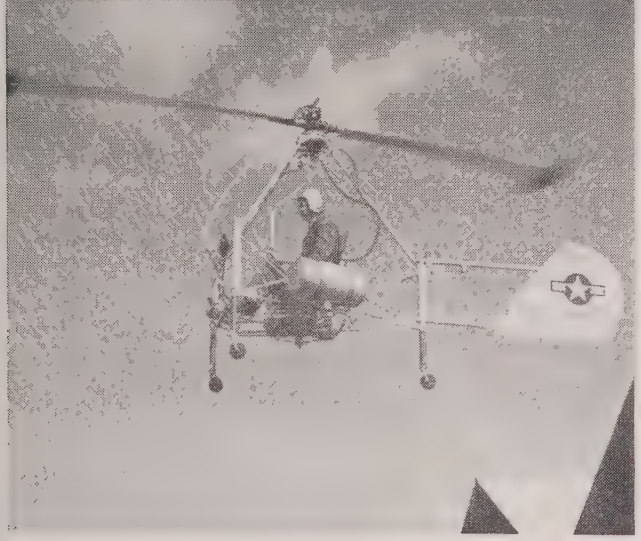


WILL jet propulsion for private flying become a reality in the near future? This question has caused a good deal of speculation, both pro and con, since the introduction of jet power.

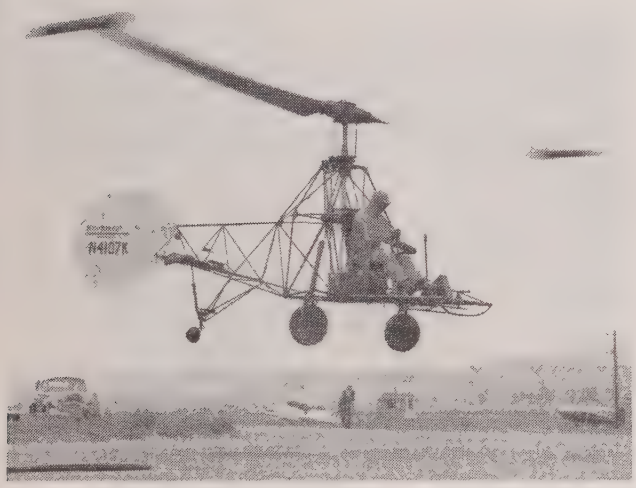
At present the jet picture for private aircraft is a clouded one. Those who argue that jet propulsion will not be ready for the private flyer for a long time to come base their opinions on the performance of today's military jet engines. It should be borne in mind, however, that much of the jet development work so far has been almost entirely devoted to military applications. As such, it is not an accurate means on which to base future predictions in connection with commercial jet propulsion of the near future.

A brighter picture (from the private jet angle, at

BULLET, designed by Johnson, utilized exhaust thrust (note exhaust "cylinder" under belly) as extra boost in speed



LITTLE HENRY, designed and built for the Air Force by McDonnell, has small 10-pound ram-jet unit on each rotor blade. Torque is eliminated. Marquardt helicopter *(below)* has pulse-jet unit on tip of each rotor blade



least) is painted by Mr. H. C. Hill, former manager of the turbine engineering division of the G. M. Giannini Company, the organization that pioneered much development work on jet engines for the government. Mr. Hill claims that "the jet-powered airplane can equal or exceed the performance of the best prop-driven engines at all speeds above the top speed of the present day automobile (100 mph). If current efforts towards improving the thermal efficiency of the gas turbine are successful, the aircraft jet engine will eventually out-perform the prop-driven engines in *all* categories, not just high-speed. This means that the jet eventually can be expected to replace the propeller even on relatively slow-speed aircraft such as the private-owner type plane."

Where do we stand today from the private plane angle? While there are no private jet planes available on the market for public use as yet, a number of energetic development projects in this country and abroad are underway which may wind up with a satisfactory solution to the problem.

At the present time, the piston engine holds the edge over the jet engine in the lower speed ranges chiefly because jet propulsion is still in the infant stages of development. Most of the efforts to improve jet engines have been devoted to high-speed flight hence progress in the private-flying range has not been rapid.

The argument that private flying jet propulsion is impractical because of the relative inefficiency of the high-speed jet-exhaust gases at low flight velocities will be in for a bit of revamping as the jet age develops. This belief is based on the performance of present-day jet engines which are designed for optimum performance at the higher flight speeds. Accordingly, it is argued that it is far more efficient (in the private flying speed range) to propel a large amount of air rearward at a low velocity by propeller than to eject a small mass rearward out of a jet engine at a higher velocity. Tomorrow's jets will disprove this by operating at higher jet exhaust velocities. The resulting increases in thrust will make commercial jet propulsion even more economical. Reducing the weight of the engine (pound of weight per pound of thrust), improving the fuels, upping the combustion efficiency, etc., will further add to the operating efficiency of the jet engines.

The weight of the (*Continued on page 44*)

FOUGA SYLPHE, formerly called *Cyclone,* is powered by turbo-jet engine that develops up to 200 pounds of thrust

Air Cadet

ADVANCED course calls for mastering intricacies of new planes, substituting jet engine thrust for horsepower

AIR FORCE pilot training is no snap, as many young men who are enrolled in the program can testify. Not long after the cadet's arrival at a basic flying school, he learns that pilot training is a serious business. Learning to fly high-powered planes and moulding themselves into Air Force officers capable of taking a place alongside graduates of West Point and Annapolis is a tough road that causes many to fall by the wayside. It's a 13 months course that graduates men from bikes to jet fighters of the Air Force.

PRIMARY TRAINING finds the Aviation Cadet in the T-6 *Texan* powered by 600-hp engine. Trainer in 1947 had only 220-hp engine. After 130 hours air time, cadet moves on to Williams AFB and the F-80 if he's going to be a fighter pilot

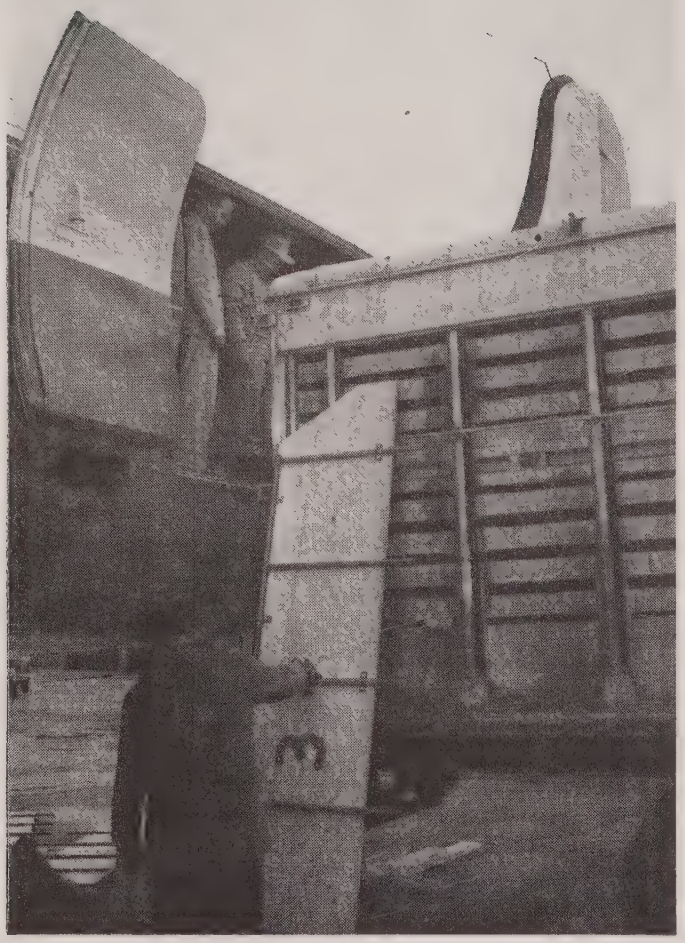
WEATHER is a "must" and the Air Force cadets get a thorough schooling in flight meteorology

ADVANCED TRAINING finds the cadet flying the F-80 under close scrutiny of his instructor and mobile control tower

TECHNIQUE sharpened, cadet is now full-fledged jet pilot, a 2nd Lt. in the AF getting an average pay of $355 per month

NEW LIEUTENANT is member of AF "all-weather" team who will see service in such far off places as Japan, Germany, India, etc.

AIR CADET who's just won his wings in jets is between 20 and 26½, has had two years of college, has passed all tests



TRUCK TRAILER is backed up to C-54's cargo door and the South America-bound livestock are direct-loaded aboard

By FRANK J. TAYLOR

Flying Tigers trade combat for cargo and fly cattle to South America

One day last winter George S. Dart, who rustles freight cargoes for The Flying Tiger Line, Inc., in New York, picked up a red-hot tip. President Mariano Ospina of Colombia had launched a program to upgrade his country's livestock farming by importing thousands of blooded breeding animals from North America. Already a purchasing commission for Colombia's Farm Loan Bank was buying bulls, heifers, horses, pigs, sheep, dogs, goats and even poultry from Canadian and American farmers. But the Colombians were having trouble figuring out how to transport the livestock.

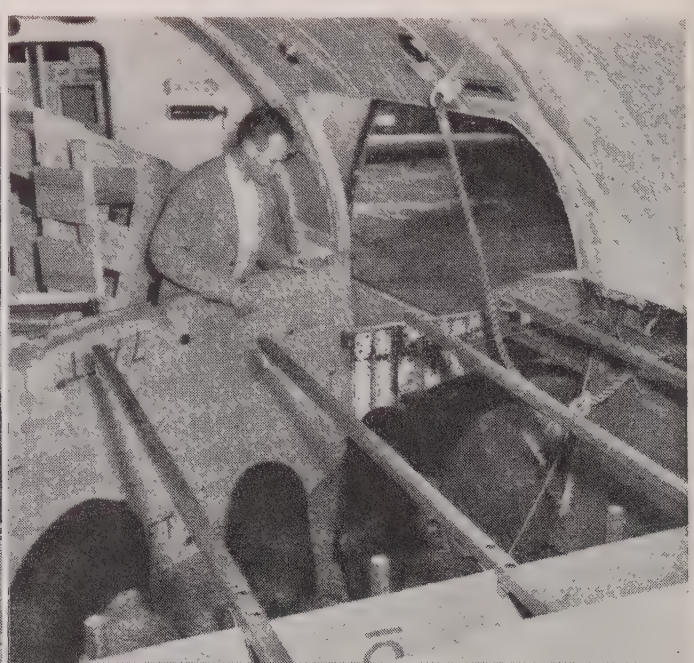
The Flying Tigers, after downing 300 Japanese planes in Central China early in the war, had switched to transport operations and flown thousands of tons of supplies over The Hump from India, and after V-J Day had organized their own air-freight line. They prided themselves on their ability to fly anything anywhere. They told customers: "If you can get it in the airport gate, we can get it into a C-54." Dart lost no time contacting E. A. Wells Castillo, Colombia's consul in New York City, and Maximilian Garavito, agent for the Colombian Farm Loan Bank.

"We'll fly your animals direct from farms in this country to farms in your country," he proposed. "They'll be grazing in Iowa one day and in Colombia the next. No feeding expenses en route. You'll save time and work and stock losses."

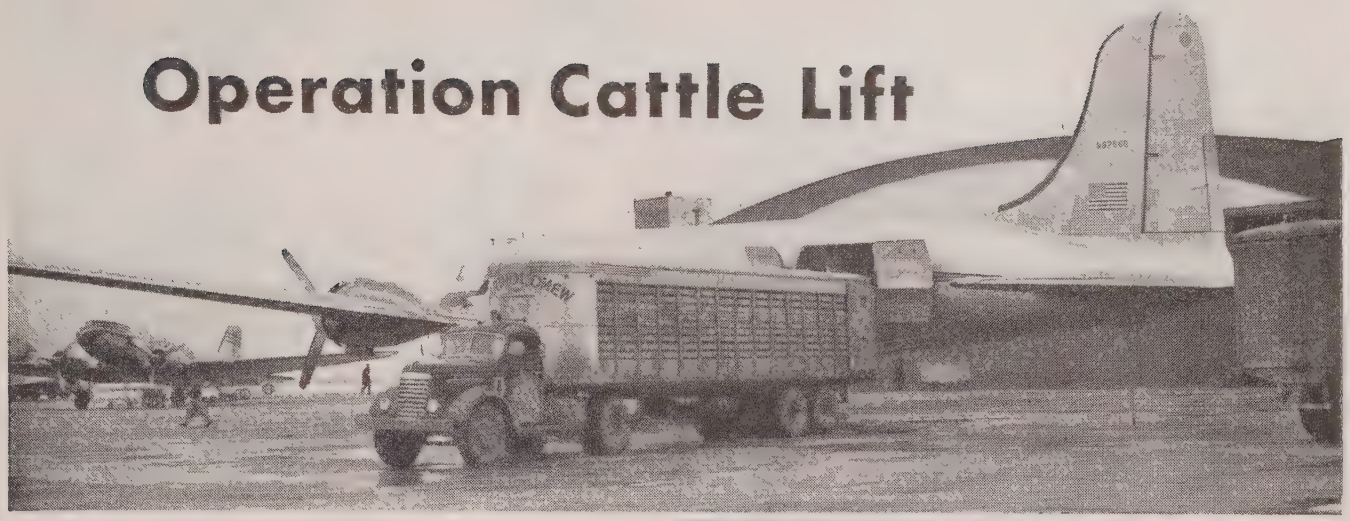
The Colombians were all ears. They had spent a million dollars for livestock. Assembling the animals at railway shipping points and again at ports, and feeding en route would cost another quarter-

MILWAUKEE to Bogota, Colombia, reads the "ticket" of this prize Holstein being led up wooden ramp to the C-54

AIRFREIGHTER is sectioned, and pigs are loaded into the bottom half of fuselage. Note plane's straw-covered floor



Operation Cattle Lift



CARLOAD of pigs recently flown to Bogota from Des Moines, Iowa, numbered 150. Part of cargo was housed on lower deck; the rest occupied upper deck that was put in place after lower deck was loaded. The load was 17,000 pounds

million. Even after they reached Barranquilla, Colombia's seaport, it was a long, hard trip by flat-boat up the Magdalena River, thence over steep mountain trails to the farmland areas. More important, they knew from experience that they would lose many expensive animals during the rugged one- to two-month trip. The stock that reached Colombian farms would be in poor condition.

"How much will it cost?" they asked.

Dart came up with a figure of $1.50 per airplane mile—about $300,000 for 35 flights to handle the 3,000 animals and 4,000 chickens and turkeys the Colombians had purchased for delivery during 1950. The cost was little more than for surface transportation, the journey was faster and easier, there was less danger of loss. It was a deal. Thus the Flying Tigers' "Operation Cattle Lift," unique in transportation, was launched last February when the first load of 20 heifers and yearling bulls and six sheep dogs was picked up one day at the snow-encrusted Montreal and Toronto airports and delivered the following day at tropical Medellin in the heart of the lush, orchid-bowered Colombia mountains.

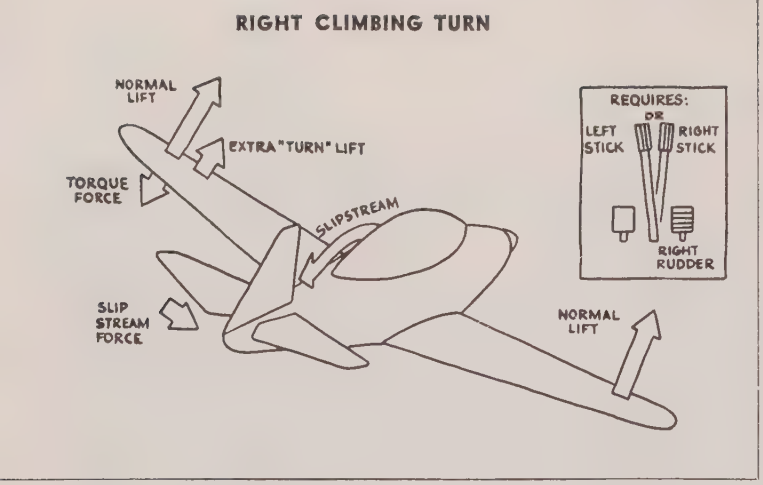
Before that first flight, the Flying Tigers had to do some energetic head-scratching. They had flown just about every kind of animal except tigers. There'd been dogs, race-horses, monkeys, elephants, cobras, a planeful of chickens from Wisconsin to Japan. The Metro-Goldwyn-Mayer lion, Elsie the Borden cow, 6,000 pounds of guinea pigs and 6,000 pounds of cabbage aboard two C-54's were flown from Westover Field, Massachusetts to Tokyo for the Army. On arrival at Tokyo the pigs had eaten all the cabbages and nobody ever has figured out what the gross payload really was! But this mass transportation of livestock was something else again. Suppose a load of young bulls went berserk in flight? Two of the Tigers' 14 four-engine transports were pulled off the regular freight runs, serving 19 U. S. cities, and sent to the home base at Lockheed Airport, Burbank, California, for modification.

There Al Goldberg, chief of maintenance, improvised installations to con- *(Continued on page 53)*

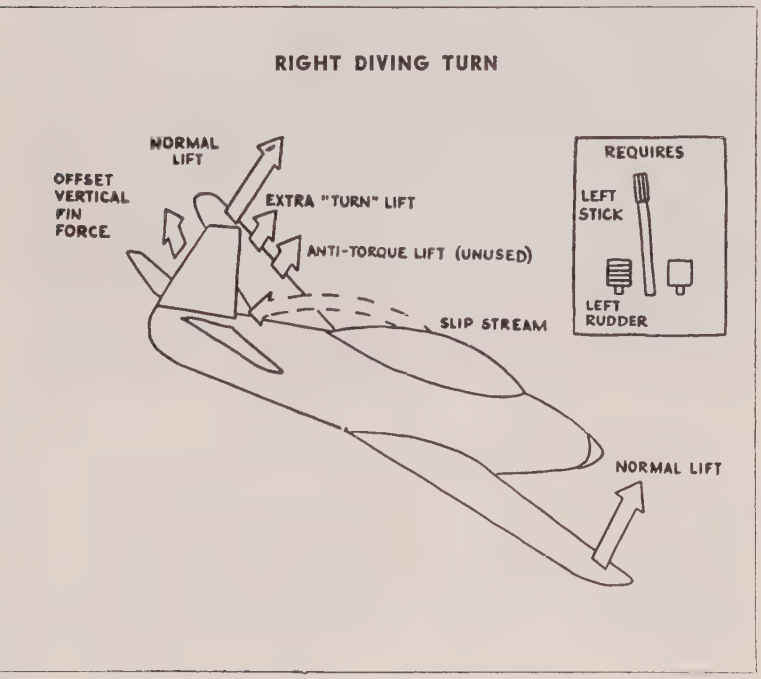
PIG about to make first flight cautiously inspects upper deck of the C-54 that will be "home" for few days

Trim That Torque!

By A. H. HASBROOK

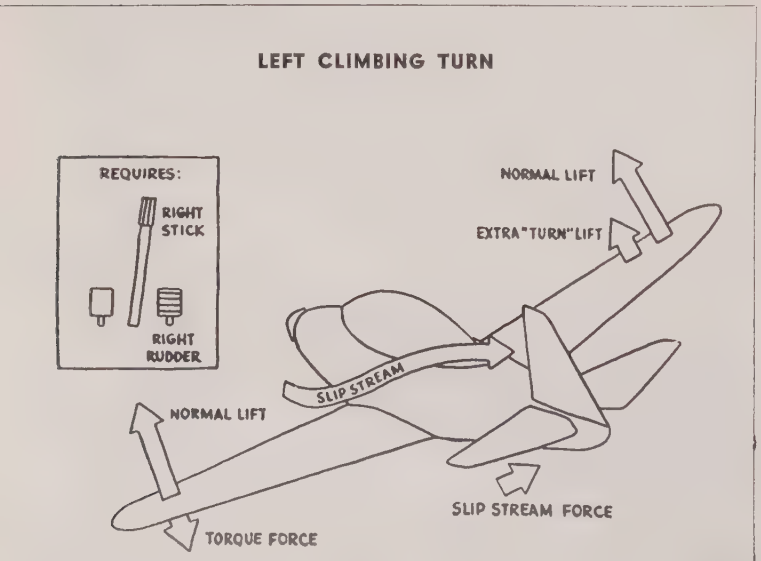


CLIMB turn to the right, added lift of the left wing will overcome torque, but will tend to cause overbanking



POWER-OFF flight, engineered torque-compensating lift of left wing tends to roll the airplane to the right

POWER-ON climbing turn to the left requires use of right rudder and right stick, once angle of bank is achieved



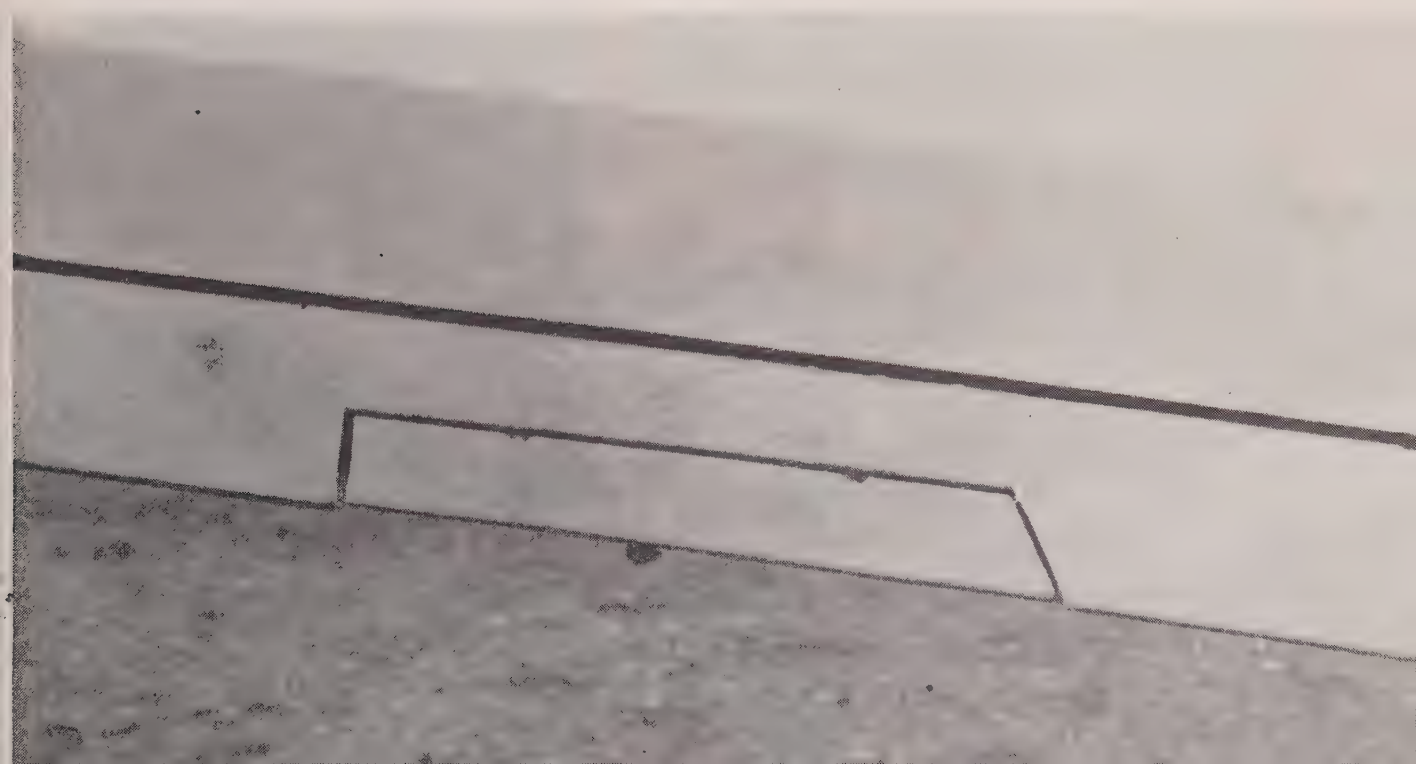
The need for a basic understanding of the effect of torque and slipstream forces has been pointed up by five years of flight checking Commercial and Private Pilot applicants. Although of great importance relative to the attainment of good coordination and flying technique, this subject receives little attention in most flying courses. This is unfortunate because ignorance or a mistaken understanding of the matter can be a factor in producing a potentially dangerous pilot. On the other hand, a good basic knowledge of torque and slipstream effect, and its relation to other forces acting on an airplane in flight, can simplify flight instruction for both the student and instructor and will assist in producing not only a smoother pilot but a safer one as well.

What is torque? In the case of the airplane, torque is an equal and directionally opposite force to that delivered by the engine to rotate the propeller. Its effect is to roll the airplane in a direction opposite to that of the propeller's rotation. The slipstream, an air mass by-product of the propeller's rotation, spirals rearward in a clockwise direction and strikes the vertical fin and rudder on the left side, thereby tending to turn the airplane to the left. Because of this combined torque and slipstream effect, most pilots find it easier to execute slow rolls and snap rolls to the left.

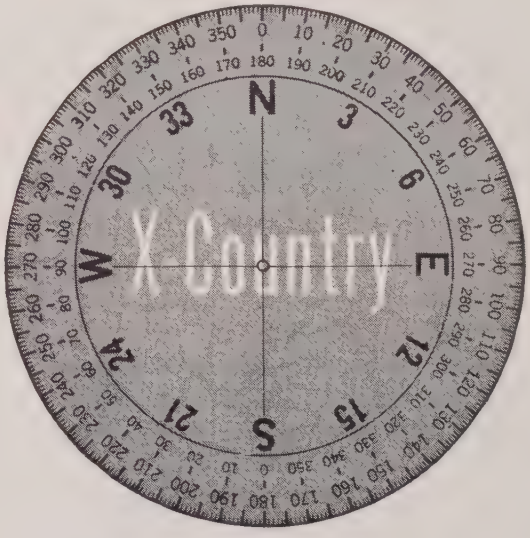
Like other forces affecting the airplane, *i.e.*, lift, drag and thrust, torque and slipstream forces vary in magnitude depending on the airplane's operating condition, *i.e.*, cruise, slow flight, climb, take-off, etc. Therefore, to achieve good coordination and optimum aircraft operating efficiency at all times, it is necessary to balance out or "trim off" torque and slipstream effect as well as the other forces. Too, this effect is most noticeable at minimum and maximum operating conditions. During cruising operation, so-called "hands off" flight characteristics are provided by engineered rigging of the wings and an offset vertical fin which counteract the effect of torque and slipstream (*Continued on page 48*)

TORQUE is an equal and directionally opposite force to that delivered by the engine to rotate the propeller

TRIM TABS on plane's ailerons make good trimming possible. Each control can be adjusted to a delicate minimum



GAL. 60 is a military transport designed and built by Blackburn and General Aircraft, Ltd., of Yorkshire, England. Second in size only to the Bristol *Brabazon*, the Gal. 60 is 99 feet in length, has span of 162 feet, and is powered by four Bristol *Hercules* engines. It carries a crew of four.



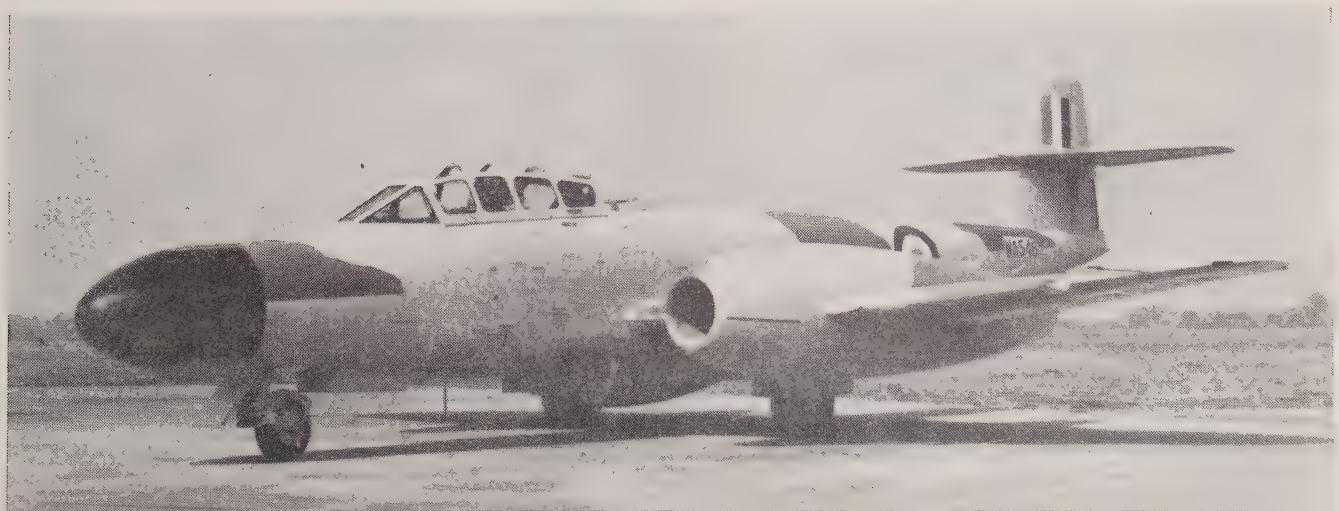
BUSINESSMAN-PILOT Charles Soderstrom recently established a new West-East transcontinental speed record of 16 hours and 12 minutes for "light" aircraft. Flying a Beech *Bonanza* equipped with VHF-Omni radio, Mr. Soderstrom averaged over 160 mph on the cross-country which took him from San Pedro, California to New York's Laguardia Airport. Before the hop Soderstrom had only few minutes instruction in use of his Lear radio equipment.

CITY OF NEW YORK Police Department recently took delivery of three new Bell 47D1 deluxe helicopters. Equipped with pontoons for over-water operations, the Bell helicopters will be used for rescue, search, and traffic control in the New York area. Like other aircraft in the Police Department hangar, the three 'copters are painted green and white, and are flown by especially trained pilots. Powered by Franklin engine, the Bell 47D cruises at 92 mph and has a 214-mile range.

DE HAVILLAND *Chipmunk*, a new two-seater trainer, was delivered to Oxford University Air Squadron recently where it will be used as standard RAF training plane. Powered by 140-hp De Havilland *Gipsy* engine, the *Chipmunk* has a cruising speed of 124 mph, a service ceiling of 17,200 feet and a still-air range of 485 miles (with metal prop). With a wooden fixed-pitch prop, the *Chipmunk's* performance is somewhat less, cruising at 113 mph, and having a range of about 443 miles.

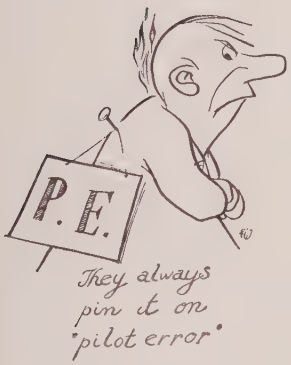
METEOR NF11 recently was assigned to the Royal Navy. Built especially for night fighting the *Meteor* NF11 features a modified nose structure which houses radar equipment and seat-space for a radar operator. Powered by two Rolls Royce *Derwent* engines, the NF11 has a top speed of over 500 mph, and a range of 450 miles without fuselage drop tanks. This range can be increased to about 1,000 miles with both fuselage and wingtip tanks added. *Meteor* lands at about 112 mph.

RANGE RIDERS ride the ranges by plane these days. Here, George Galloway, a wheat and cattleman from Wakeeney, Kansas, rides the cowling of his Ryan *Navion* for the photographer covering a meeting of some 250 Flying Farmers from Kansas. The Kansas Flying Farmers Association held its fifth annual convention at Topeka, and its members flew in from all over the state and in almost every type plane. Galloway's been flying for some time.



"Pilot prelude to disaster while a weatherman burns"

By S. H. Warner and R. Osborn



Top Billing—If you are going to have an accident, the odds are that it will happen to you while making an approach or landing, rather than during any other phase of flight. What's more, if you do have such an accident, the odds are that it will be *your* fault.

I know many aviators feel that this "pilot error" tag is muchly overworked. Let's review several of these accidents, and let you be the judge.

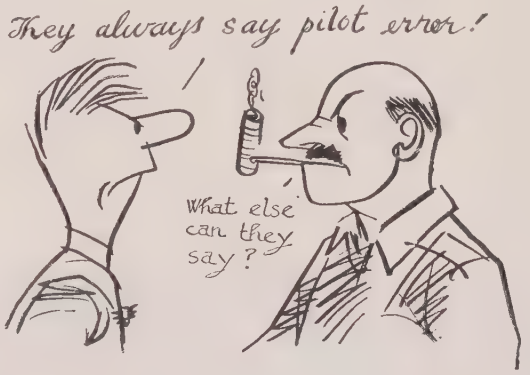
Just prior to touchdown with his high-powered plane, this pilot decided to go around again. He applied full manifold pressure with one rapid movement of the throttle. He went around all right—around the longitudinal axis. For a long time they called this pilot "baldy".

How would you score that one?

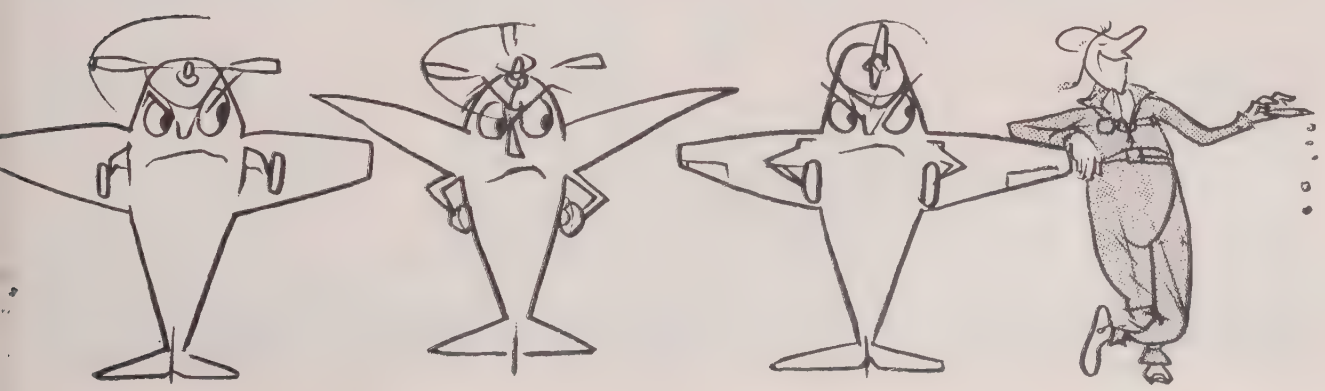
Take the case of the transport pilot who had a bad habit of aiming just short of the runway, relying on the airplane's ability to float onto the strip. One night this pilot landed with a full load and less flotation. He made the runway, but minus his landing gear.

How about that one?

Then there's the transport pilot who floated several hundred yards past midfield before contact. Instead of going around again, he attempted to stop his fully loaded bus in 1200 feet. Can't be done, you say? He proved it. Wouldn't you score that one as pilot error? (*Continued on page 50*)



"Planes are much more dependable than the Dilberts"



CAOA REPORT . .

CORPORATION AIRCRAFT OWNERS ASSOCIATION, INC.

Corporation Aircraft Owners Association is a non-profit organization designed to promote the aviation interests of the member firms, to protect those interests from discriminating legislation by Federal, State or Municipal agencies, to enable corporation aircraft owners to be represented as a united front in all matters where organized action is necessary to bring about improvements in aircraft equipment and service, and to further the cause of safety and economy of operation. The CAOA headquarters are located at 444 Madison Avenue, New York 22, N. Y.

Radio Equipment

At the personal suggestion of Charles F. Horne, Acting Director of the Office of Federal Airways, the revision of the Directory includes more details about the advanced radio equipment installed in CAOA member aircraft. Even a casual glance through it reveals the fact that on the whole our members meet a high standard in this important phase of executive aircraft operation.

Practically all of the multi-engine ships have two-way VHF backed up by a variety of extra VHF sets and LF equipment, with marker beacon receivers and radio compass. Many also have VOR receivers, ILS, dual ADF and an autopilot. A fair number have ship-to-shore radio telephone, and a few have already installed the recently available Zero Reader. The four-place single-engine aircraft are also exceptionally well equipped.

This equipment should add greatly to the safety, utility and flexibility of our executive aircraft operation.

Under the Wire

Two additional CAOA members were accepted by the Executive Committee a few hours before final proofs for the revised Directory of Executive Aircraft were okayed.

The first was Eastman Kodak Company, Rochester, N.Y., which operates a Douglas DC-3. Official in charge of the aircraft operation is C. H. Vayo, General Traffic Manager. Joseph W. Clemow is company pilot and CAOA representative.

The other was The Murray Corporation of America, well-known body builders of Detroit, with branches in various parts of the country. The Murray Corp. DC-3 is based at Detroit City Airport. E. C. Spencer is Air Transportation Manager and Chief Pilot.

CAOA Fleet

Of the aircraft operated by our membership, 74 per cent are multi-engine, and 26 per cent are single engine, mostly four-place. Multi-engine models include DC-3's, *Lodestars*, Twin Beeches, *Mallards* and *Widgeons*, Lockheed 12's, *Venturas* and B-23's and the A-26, B-25, C-87 and LB-30. Single-engine planes include *Bonanzas*, *Navions*, Cessna 190/195's, and a Beechcraft D-17, N.A. SNJ, Spartan, Howard, Cessna 140, *Voyager* and Ercoupe.

1950 Airport Directory

We are glad to call to the attention of all CAOA members the Airport Directory for 1950, now in its 14th edition, but published for the first time by McGraw-Hill. It appears in a new handy format, 8½ x 5½, and its 262 pages are packed with the most detailed and valuable information about our nation's airport facilities.

A partial list of contents will reveal its practical usefulness and give an indication of the immense amount of work which went into its compilation: CAA—Regional and District Offices, with map; Airport Directory Listings by States (bulk of the book); Seaplane Facilities; Airway Radio Communications & Aeronautical Facility Identifications; U.S. Weather Bureau Offices; State Aviation Boards & Commissions; Municipal Aviation Officials; State Aviation Motor Fuel Taxes, Refunds and Exemptions.

More Airport Notes

Robert E. Miller, president of the National Terminal Service Co., Inc., Willow Run Airport, Ypsilanti, Michigan reports that Willow Run has definitely allocated Gate 10 on the south concourse to incoming executive and other privately owned aircraft. A sign has been erected with instructions as to how to reach the tower, Weather Bureau, base operator, etc. There is no landing fee.

Capital Airport, Springfield, Illinois is operated by Springfield Airport Authority, and Manager Russ Johnston extends a hearty invitation to use the excellent facilities offered by Capital. These include three 5300-foot concrete runways, radio, range station, CAA communication station, Weather Bureau, meals, service shop.

At the request of the respective organizations copies of the revised CAOA Directory have been sent to the executive secretaries of the Airport Operators Council, the American Association of Airport Executives, and the National Assn. of State Aviation.

Civil Aircraft in a War Emergency

Will the airlines and company operators lose a large proportion of their aircraft, and will all civil aviation except Civil Air Patrol be grounded as it was in World War II? Will company operated aircraft be classified as essential or non-essential to the war effort? If essential to companies whose major activity is essential to the war effort, how do we get a ruling on whether or not our particular company's activity is essential or not? How about company pilots who are active members of an Air Reserve or Air National Guard unit? If the unit is called up, where do they fit? Will they be exempted from military service as already performing an essential function in the war effort?

These are natural questions being asked by thousands of companies today. At press time CAOA headquarters had no definite answer as no top-level policy has yet been set on these and many related matters. Present thinking of the National Security Resources Board (Symington) is that aircraft operated by companies engaged in essential work will not be taken over. We are keeping in touch with this situation.

Pilot Error

The following definition of pilot error appeared in an article by Dr. A. D. Tuttle of United Air Lines published in the *Journal of Aviation Medicine*, June 1939:

"Pilot error is the failure of a pilot to do that which a pilot of high skill and prudence would do under the circumstances, or the doing of that which a pilot of high skill and prudence would not do under the circumstances."

Copilots for Executive Aircraft

As a footnote to his CAOA Forum paper on "Safety in Executive Aircraft Operation" Jerry Lederer has supplied an opinion on co-pilots. (1) All multi-engine aircraft from Twin Beech up should have copilots. (2) They should have commercial rating with instrument tickets and current experience (have done at least six instrument let-downs on that particular airplane). (3) A & E mechanics experience highly desirable.

COMPANY NAVION—K. G. Self *(right)* is met at airport by one of his company's dealers

Read Me the Road Map

(*Continued from page 13*)

or I were too familiar with the location of ie gages and the gadgets. Mitchem put the perations manual in his lap and read off ie check list. If we'd have been a little uicker, we'd have saved ourselves a lot of ouble later on.

Just as I picked up the mike to ask the an behind the glass for immediate take-ff, he beat me to the punch.

"*Navion* six-zero-King, Ryan requests that ou return to the factory."

We couldn't very well pretend we hadn't eard and go ahead and take off, so we undled back across the field and taxied up the factory gate. Had we forgotten to sign ll the papers, had the trip been called off r had someone's check bounced? It was orse than that. There were 50 pounds of pare parts slated for Reading. With our ad of passengers and baggage, we'd already ft the reserve tank half empty to keep from nning over full gross weight.

So we repacked the normally spacious aggage compartment, cramming a new hrome spinner and two gallons of paint board. Two heavy recording tachometers ent in front of the right seat to keep the G somewhere within limits and keep the ilskid off the ground when the passengers limbed aboard. Weight and balance? We ad the weight!

We taxied back out to the runway, ran p the engine and pushed the middle valve own before anyone thought of something lse for us to take along.

Fortunately our *Navion* was the twentieth roduction model of the big 260-hp Lycom-ng installation. The fully loaded ship hopped ff the runway as though it'd been goosed y a *Cub*, and we were on our way.

"Gear up," I called.

"Gear up yourself," Mitchem growled, you're flying it—unless you have too much handle alone."

I pulled the gear.

Fifteen minutes later, the road map was Mitchem's lap and we were driving down ie highway over the Jacumba pass. The eiling was 701 feet above the terrain. It had be that to make the flight legal!

Once in the clear beyond the Laguna Mountains, we settled back to enjoy the ip. It's tougher to keep a small plane—even ie stable *Navion*—headed on course than transport plane. The compass is about the ze of a pocket watch and sometimes I'd fly ve or 10 minutes at a time with my heading ay off the beam. In a big airplane, besides ie king-sized regulation compass, you have vo big radio compass dials, a gyro com-ass and usually a remote-reading flux-gate ompass. If you're more than a couple of egrees off your heading, the cockpit prac-cally lights up and says "tilt."

But the route over the sand dunes from l Centro, California to Yuma, Arizona is as lain as the curves on a blond and we fol-wed the highway to Yuma, turned north the second river and followed the dry ash of the Gila River into Phoenix. Time: vo hours; distance: 340 miles.

Actually, there's almost as much cockpit rocedure on these little airplanes as there on a DC-4—except that you have to do ost of the items four times on the bigger planes. Mitchem resurrected the operations manual as a reminder to pull all the necessary gadgets. Two hops later he noticed the check list printed on the little wind deflectors above the front windshield. The factory won't turn you loose in one of their new ships without a check-out flight, but it takes more than one hop around the field to become familiar with anybody's cockpit. You always feel as though you've left something un-done.

We called the tower at Phoenix and received a straight-in clearance.

"Use caution," advised the Skyharbor tower. "Wind is from the south 30 mph with strong gusts."

I started the usual dragged-in transport approach—straight in for the last four miles and not over 500 feet for the last two miles. Then I remembered it was bad manners in a single-engined airplane, just in case that one engine should decide to quit.

The big tricycle gear of the *Navion* made both of us feel right at home. You sit nearly 15 feet closer to the ground than in a DC-4, but the ship lands just about the same. Flap action is tops—so good in fact that I would have undershot the airport if I hadn't added a lot of power. Man, those big flaps really slow you down.

You get in the habit of trying to plant your wheels in the warm-up circle in a big airplane and I sure felt foolish when six-zero-King was on the ground and stopped with still a mile of un-used runway ahead of us.

The main difference I found between the C-54 and the *Navion* was in taxiing. The central brake lever takes quite some getting used to when you've been working for years with toe-brakes. Even on my last landing, I was still trying to steer with brakes that weren't there. Even more, I missed the little wheel that turns the nose wheel on the C-54. That's why they're so easy to park.

When we set the parking brakes, I searched all over the cockpit for a control gust lock that wasn't there. That's what comes from being used to big stuff.

At Skyharbor we gassed and wolfed a quick sandwich. It was hot on the ground and the two big ice-cream cartons full of water and chopped ice (for free, too!) were as welcome as a gambol with Grable on a green. In fact, service at all the airports we touched was head and shoulders above the slipshod operation of the not-so-good old days.

With our load of baggage and spare parts, we filled the rear tank only half way and filed a flight plan for Tucumcari with Albuquerque as an alternate. They're a little fussy these days about flights in the area of the White Sands atomic proving grounds, and the last thing we wanted was an inquiring Air Force jet-power F-86 as an armed escort.

By the time we climbed out of Phoenix's "Valley of the Sun," the sky was dotted with thunderheads and it was just too doggoned hot at the lower altitudes. The combination exhaust ventilator and "disposal unit" for gum wrappers helped keep the cabin cool but we nearly siphoned the wallet out of Mitchem's coat that was lying on the back ledge aft of the seat.

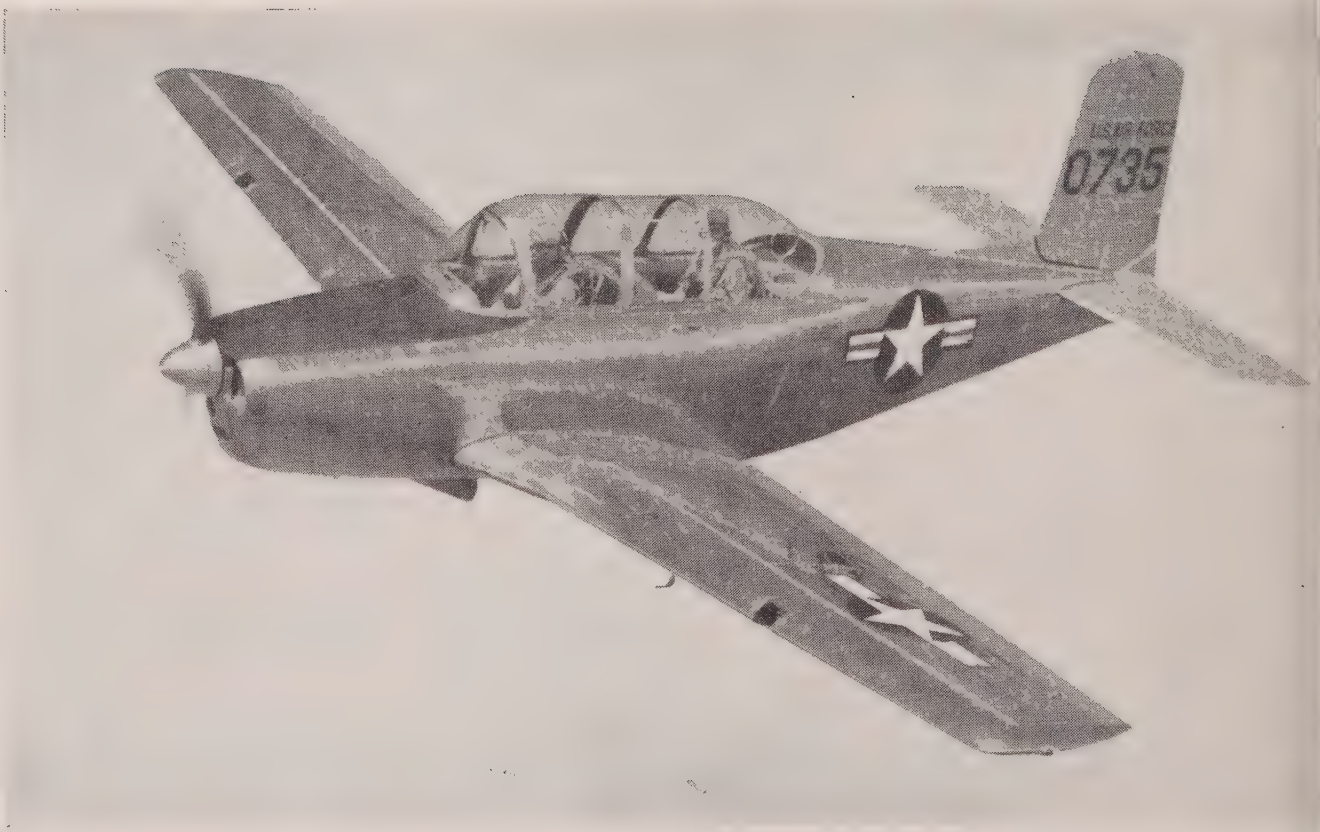
We poured on more throttle and climbed to 12,000 feet over the gaudy Rock Creek Canyon of Central Arizona. The manifold pressure gage showed only 18 inches—but there was no high blower. Fifteen minutes at full-throttle climb makes only a small dent in the gas gage reading of a C-54 with 15 hours fuel, but the same 15 minutes climbing to cruising altitude makes a startling dent in the gage readings when there is only 4 or 5 hours of fuel aboard, as in the *Navion*.

As we leveled off over northern Arizona, Mitchem mused, "Just what would you use for a landing strip if the engine quit?" I ignored it 'cause he's the worrying type, but my fingers still have a Charley horse from being crossed.

Heat lightning made a curtain of static that cut radio-range reception to a noisy jumble, so we took the short-cut route to Albuquerque rather than flying the dog-leg up over Winslow. I tried to let the airplane find its own way through the choppy air, but our passengers soon complained and I had to put my feet back on the rudder bar and keep two fingers on the wheel. You can fly a C-54

(*Continued on page 37*)

AUTHOR and Stan Mitchen unload baggage after a night landing at Amarillo, Texas



BEECHCRAFT YT-34 is powered by Continental E-225-8 engine and it will cruise some 770 miles on 50 gallons of fuel at 60 per cent pow

YT-34 in Service

PILOTS at Randolph Field, Texas, recently took delivery on the initial quantity of two Beechcraft YT-34's. These two trainers will enter service tests immediately, and it is currently planned to have the YT-34 evaluation program carried on within the actual flying training syllabus.

The YT-34 is a development of the Beech Aircraft *Mentor*, a postwar design. The YT-34 is a multi-purpose trainer powered by a 220-hp (for take-off) Continental engine with an all-metal constant-speed propeller. Cruising at 60 per cent of power at 10,000 feet, the YT-34 gives a true airspeed of 167 mph. Sea-level top speed is 188 mph TAS, and the design dive speed is 280 mph Indicated. Service ceiling, obtained with an engine at rated power of 205 hp, is 21,200 feet.

Acceleration on the ground, as in the air, is rapid, and the trainer can get off over a 50-foot obstacle in an easy 918 feet.

In maneuvers, the YT-34 has a very rapid rate of roll and requires very little correction for adverse yaw. A single snap roll comes through at 120 mph with lighter control pressures than most planes require. The slow, or aileron, roll can be accomplished at very slow airspeeds. Actually, this new Beech can be rolled inverted at 100 mph Indicated, and then climbed 300 feet before a stall.

With full flaps, the Beechcraft YT-34's landing speed is 54.3 mph, and aileron control remains solid all the way to the ground. The plane can be landed short: in an easy 820 feet over a 50-foot obstacle.

Power-on stalls with gear and flaps extended come at 50 mph Indicated, with a very noticeable tail buffeting effect. Spin recovery is by standard NACA method, and takes less than a turn to accomplish.

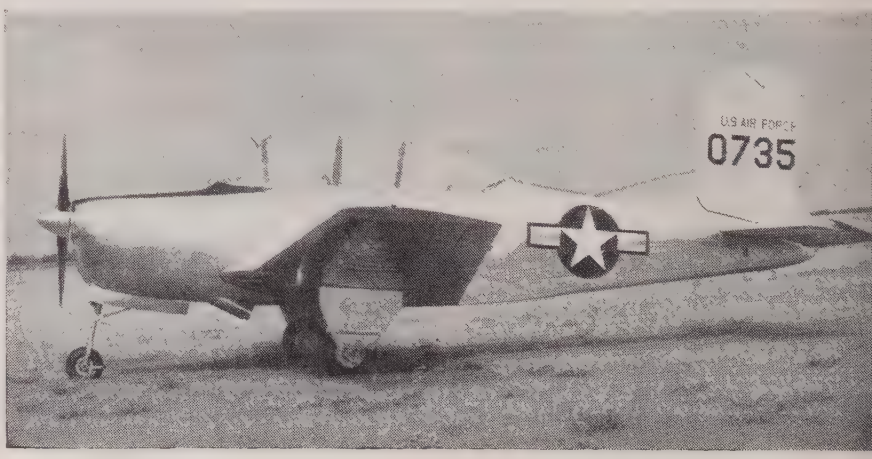
The performance pattern of the YT-34 is almost that of the old 650-hp T-6 trainer, but the YT-34 requires just a third of that power. An estimate, based on flight and maintenance data, is that each YT-34 would save 150,000 gallons of aviation fuel during a five-year period, over that required by the World War II T-6.

This new Beechcraft military trainer goes into service tests carrying a CAA Approv Type certificate under Part 111 of the CA

As a working trainer, Beechcraft pil who have flown the YT-34 believe the spee plane will become widely accepted by instr tors and student pilots alike. For dual struction, day or night, the YT-34 offers t instructor riding in the rear seat enou headroom to raise the seat to a higher le than the student's position. With the lo flat engine, the YT-34's visibility is excelle Another safety aid at night is the taxii light mounted on the nosewheel strut. Th feature eliminates excessive glare in the ey of other students.

When the Air Force has completed test, the Beechcraft YT-34 will under further "shakedown" by the Navy at Pe sacola, Florida.

VISIBILITY from either front or rear seat is excellent. Prop is constant-speed typ



Read Me the Road Map

(*Continued from page 35*)

with only aileron, but the linking bungee system on the *Navion* makes it easy to handle with either rudder or aileron. I'd actually forgotten just how rough ordinary rough air can be. A small bump in a C-54 is a knot-on-the-noggin' in a lightplane.

As San Francisco peak disappeared behind our left elevator tip, navigation again became something of a problem. Mitchem put down the operations manual and reopened Rand McNally's road map. We weren't actually lost, mind you, but. . . . The south wind must have shifted because we missed both El Morro and Acomita radio ranges by about 20 miles and had to turn north to Albuquerque when we hit the silvery (*per se*—muddy) Rio Grande.

Our fuel seemed to be holding up fairly well so we radioed a position-report over Albuquerque and plowed on eastward. Since we hadn't filled the rear tank at either San Diego or Phoenix, we had no accurate gallons-per-hour check on the new engine. And since Albuquerque is located just west of a high ridge of mountains, we decided to nurse our gas along and not let down into the valley and have to climb back up again.

We passed the CAA emergency field at Otto and purred along toward Tucumcari. We could almost see the town on the horizon when the bottom dropped out of the gas gage. We looked at each other and said in unison those famous last words of many a good pilot, "Maybe it's the gage."

The WAC chart (World Aeronautical Chart) showed a CAA emergency field just 6,000 feet below us and seven miles north of the highway we'd been following. Then we took a look at the ground—something you seldom do in a C-54. Thar she was—a beautiful (to us) "pea patch" airport right on the edge of town—population 80 people. We circled down at a safe altitude and took a closer look. It was short and rolling.

"Definitely no field for a 54," said Mitchem.

"But it's a lot closer to town than the CAA field, and we can probably get gas from the station along the highway," I answered as I pulled the hydraulic bypass, slowed to a hundred and dropped the gear.

Our "pea patch" was no C-54 strip for sure. Just about the time we came across the barbed-wire fence, I had to haul back on the wheel and we squatted into a roller-coaster rise at one end of the runway. We skidded to a stop with plenty of room to spare and taxied to the corner nearest town.

After a couple of slow, deep breaths, we climbed out. No one came to greet us—not even a dog. So we ducked under the barbed-wire fence erected to keep cattle from lunching on fabric airplanes and walked across the railroad tracks into town. The one general store—a combination gas station, bank, bus stop and garage all-in-one—seemed to be the best bet for gas.

Did they have any 91 octane aviation fuel?

No, they didn't. Well, where could we get some? They didn't know. Cuervo looked like a mighty poor place to find high test fuel. We were just about to phone the Tucumcari Airport to fly us out some gas when a lady leisurely buying a pair of cotton underdrawers said slowly, "You want plane gas? My husband has some cans of plane gas in the back of the shed. He's caretaker at the CAA emergency field. If you'll wait 'til I get my shopping done and pick up the girls from the school bus, I'll run you out there."

We waited—and the sun kept right on dropping in the west.

To tell the truth, we were both a little skeptical about the whole thing, but we didn't have too much choice in the matter. Finally we bounced out along the rutted dirt road to the CAA field. A mile farther on was a sheep ranch and the CAA caretaker.

"Gas? Sure. There's plenty of it at the field, but it'll cost you 40 cents a gallon. Is that all right?" he asked apologetically.

Right then we'd have gladly paid a lot more than four dollars for two sealed five-gallon cans of 91 octane gas.

"I'm kinda glad to get rid of the stuff," said the caretaker as we drove back toward town. "Just got notice from the CAA yesterday that they're closing this field first of the month. Economies or something. Seems a shame, don't it?"

We agreed, because those lighted emergency fields a hundred miles from nowhere sure look good on a dark night, even to a four-fan pilot.

The caretaker helped dump 10 gallons into the *Navion* and we taxied out past two dreary looking cows munching grass on the edge of the runway. We gunned the engine to scare them off and they didn't even look up.

"Those aren't cows," quipped Mitchem, "they're the latest in airport lawn mowing equipment."

It wasn't without misgivings that I lined up on the short rolling strip, dropped half-flaps and poured on the juice. The altitude was 4,734 feet and it was still warm in the late afternoon. I hauled all the way back on the control column to keep the prop from picking up pebbles. This time Mitchem snapped the gear-up lever as soon as I gave him the up-thumb. We made it over the non-restraining cow fence with plenty to spare, circled quickly over town and headed down the highway to Tucumcari.

Twenty minutes later we were parked at the Tucumcari gas pit. After checking the fuel aboard, we figured that we would have had an even three gallons in the tanks if we had gone on without landing. That's just like being down to your last hundred gallons in a C-54.

It was nearly dark, but the Tucumcari Airport was out aways from town—and the lights of Amarillo looked brighter. Mitchem took off and made the 106 miles in 40 minutes. With a big airplane, you land in Amarillo at English Field—quite a downward spit and a jump from town. We landed at the closer-in Tradewinds Airport where the landing lights were just beginning to glow brightly on the grass strip. It was Mitchem's first landing in a *Navion* and he, like all the rest of us, over-controlled a little with the light-on-the-draw controls. By comparison, you really roll up your sleeves and drive a big airplane.

Since the country was clear and the weather report good, we took off the next morning without a flight plan. To tell the truth, we weren't sure whether we wanted a late breakfast in Wichita or an early lunch

(*Continued on page 47*)

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Piper Super Cub

(*Continued from page 15*)

Super Cub 105. The *Super Cub* 95 is primarily a training airplane, while the *Super Cub* 105 is the workhorse ship. One model of the "105" is equipped with a tandem landing gear, meant for climbing out of the poorest of airports—mud, cinders, rocks or bulrushes notwithstanding; the other model is the crop duster.

Arrangements were promptly made for your reporter to fly the new Piper at the factory, and my flights in the 105 at Lock Haven proved to me that Piper again has done a terrific job in providing a pair of airplanes of guaranteed utility.

The "95" with its 90-hp Continental cruises at 95 mph. It might be classed as the best training ship the factory has ever produced. With an eye to maintenance, it's been kept simple, and comes with a minimum of equipment and gadgets. With full fuel load (18 gallons in a left wing tank), two 170-pound persons and 50 pounds of baggage, the *Super Cub* 95 still has an additional useful load of about 200 pounds.

The "105" model, with its 108-hp Lycoming 0-235-C1 engine, cruises at 105 mph.

The exterior construction has been changed slightly. Balanced elevators and flaps are featured on the "105". At its slow "hovering" and landing speeds of well under 40 mph, these give it the necessary extra control and stability.

They've made servicing easier, too. The cowl can be propped open with a bar that is clamped to the foreside of the firewall when not in use. With the cowling stripped, the engine mount can be swung out from the ship some 8 inches to facilitate work on the electrical system.

The ship is fabric-covered, and the fuselage is welded steel tubing, with the wings made up of aluminum spars and nicral ribs. The sides of the cabin are now all-metal and easily removed for servicing controls.

The interior of the PA-18 carries many modifications and improvements. There's a good deal more room in the new model, thanks to the new, full-rectangular center section and the elimination of the two diagonal top members that were in the cabin of the old model. The wings now are secured to the fuselage outside the cabin.

The left window has two panes which slide fore and aft, and can be securely closed if desired. The door on the right is the same two-section, up-and-down type used on the earlier ships.

The tandem seats are considerably altered. They are leatherette-covered, of spring-construction—and comfortable. The seats are made to fit the pilot, being adjustable forward and back. For the shorter pilot, the seat goes forward and higher at the same time, thus increasing his visibility while bringing him closer to the rudders.

Behind the rear seat is a baggage compartment with a capacity of 50 pounds. If the cargo space is needed, the 18's rear seat comes out, providing an area of a little more than 11 cubic feet.

The gas tank is in the left wing and optional equipment includes an extra 18-gallon tank in the right wing. The gage is a glass tube on the upper left side. The trim tab is the same as in former models—a chrome crankhandle.

Last Flight

Employees of Swissair Line have said "Goodbye" to a grand old lady of the skies. Once the Flagship of the airline, this Fokker F. VII recently was flown into Berne Airport, Switzerland, from which point she was taken to the Berne Traffic Museum. Back in 1930, this single-engine eight-passenger plane was shiny new, and she showed the Swiss flag in a score of big cities on her air routes. Twenty years later, when she was brought into Berne Airport, the pilot at the controls was the same man who'd flown her in the early 30's, veteran Commander Nyffeneger. Today, fast Convairs, Connie's and DC-4's dot the airways, and there is many a pilot at the controls of those planes who remembers well sitting behind the controls of the Fokker F. VII some years ago.

The first "105" I flew was equipped with a metal prop and tandem landing gear. A word about that gear. Manufactured for all Piper models by Art Whitaker of Oregon, it consists of two balloon-tired wheels mounted one ahead of the other. The wheels take their bearing between the two wheels on the original axle shaft. The front wheel, which has no brake, is inflated to 4 pounds, while the rear wheel has 8 pounds pressure and brake. This gives the gear a rocker or caterpillar action which takes it up and over obstacles, through mud, plowed fields, rocks, etc. This gear has been specified on 12 airplanes to be used by the U. S. Coast and Geodetic Survey in Alaska this summer.

For the pilot's report, I climbed into the "105", set the seat full forward, got a spin from one of the boys, let her warm up, and then set off down the taxi strip. The visibility is certainly good. I taxied with the right gear on the rough field and the left on the strip, then crossed over and continued down the rough area to the side of the main runway, looking for hummocks, holes, rocks. That gear did a good job of cushioning all the jars.

At the end of the runway I checked the mags, controls, and pulled on full flaps. I gave her full throttle, and was off in less than 6 seconds and climbing well over 1,000 fpm. That 108-hp engine can deliver 115 hp at 2800 rpm for one-minute operation, if you need it.

Raising the flaps gives a "nose-sink", and it's then that you experience the heavy stick pressure needed to get your desired elevator function. Maybe, as S.O.P., you've trimmed for climb without thinking, but in the *Super Cub* you'll re-trim for any change in flight attitude.

Stalling the *Super Cub* takes patience and fortitude. Applying full flaps, which hikes the nose up pretty high, I continued to pull back on the stick. With a nose-high attitude, at which the airspeed indicator goes below 30 mph and you can forget about its operation, I sat there and hung. This is as close to "hovering" as I've come since a ride in a helicopter. When you finally get your stall, a slight push forward gives you back your airspeed. This "hovering", though, allows maneuverability, control, and maintenance of altitude to an amazing degree.

I raised the flaps and re-trimmed for level flight. Though there is slight drag to the tandem gear, it is not bad—certainly not over 3 or 4 mph. You still get pretty close to the claimed 105-mph cruise.

The ship handles well, and there's not much *Cub* feel left about it. Coming in for a landing, full flaps, around a 55-mph glide, have your stabilizer trimmed pretty far back. You may think you're coming back sufficiently on the stick, but she sits down "shorter" than you anticipate.

What was left of that afternoon after the "test" flight in the "105" I spent leisurely wandering around the big Piper plant, looking at new fabrics, watching new paint jobs, and the application of a new flame-resistant treatment called "butyrate". The fabric gets 10 coats of this: six clear, two silver and two color. Fire will melt it, but it's quite a long time before the fabric can be reached by the flames.

First ship scheduled to come off the line the next day was the crop-duster version of the *Super Cub*.

Here, for the first time in production, we have a combination duster and sprayer. The dust hopper, also designed by Art Whitaker, is built into the ship where the rear seat would be on the standard 105. It will carry over 9½ cubic feet of dust or 60 gallons of liquid. This double-barreled threat to insects, weeds, blights, etc., has been flown with as much as 1,000 pounds of dust plus fuel and pilot. We are told this load will be permissible under the projected CAA rules allowing a pilot to carry any load he feels is okay as far as field and air conditions are concerned.

The tank for spraying has small pipes extending on booms under both wings to discharge the spray through 24 diaphragm valves and nozzles. The change from dust to spray operation requires a little over an hour. Other units provided to meet agricultural problems include duster only, large spray unit only (with a capacity of 85 gallons), and a belly-tank sprayer which allows the retention of both seats. Mr. Piper expects to sell several hundreds of these this year. After watching the ship's performance, I don't think he's being over-optimistic.

Over on the river the next afternoon, the "105" *Super Cub* on floats did a beautiful job of getting off the water in from 8 to 10 seconds—even though it was saddled with a slow-turning wood prop. I got quite a charge out of landing it with full flaps. A good wind was blowing across the river, and all you had to do was point your nose at the mooring, pull flaps on and wait. She came down like a well-oiled elevator!

The PA-18 *Super Cub* is the only two-placer the Pipers will produce this year. For pleasure, business, and cross-country comfort, they're producing their three models of the four-place *Pacer*—the 115, 125, and 135 which has the Aeromatic F 200 H prop. All ships are available now and it's the customer's choice in just about everything—color job, electrical system, gages, extra fuel tanks, duster, sprayer, tandem-gear, floats, flaps, etc., at slight extra cost. Electrical system is standard on the *Pacer* only.

I guess the Pipers have come the closest yet to covering all possible fields of today's practical demand for light aircraft.

Specification Data

Full Gross Load (equivalent of 3½ passengers). Performance figures given are for airplane equipped with slowest turning fixed-pitch propeller, at gross load, under standard conditions.

	"95" ($2795.)	"105" ($2995.)
Engine	*Cont. C-90*	*Lyc. 108*
HP and RPM	*90 at 2475*	*108 at 2600*
Gross Weight (lbs)	*1500*	*1500*
Useful Load (lbs)	*710*	*675*
Wing Span (ft.)	*35.3*	*35.3*
Length (ft.)	*22.4*	*22.4*
Height (ft.)	*6.7*	*6.7*
Baggage Capacity (lbs)	*50*	*50*
Cruising range (miles)	*360*	*270*
Service Ceiling (ft.)	*13,500*	*15,750*
Fuel Consumption, F.R. (gal./hr.)	*5*	*7*
Fuel Capacity (gal.)	*18*	*18*

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Name.....

Address.....

Douglas A2D

(*Continued from page 11*)

military missions that it could not accomplish with either reciprocating or pure jet power. For the first time in a U.S. military airplane the advantages of the turbine engine and the advantage of the propeller are successfully wrapped in a single package, and the tactical punch it is designed to deliver may go a long way in determining future air-power policy.

E. H. Heinemann, chief designer of the A2D, has this to say in reference to the turbo-prop: "In pure jet propulsion, some operational characteristics are sacrificed for greater speed. In pure jet, range is often restricted due to excessive fuel consumption, and take-off and rate of climb may be affected by the relatively low static thrust of pure jet power. The jet must have both altitude and speed to operate efficiently.

"In the A2D, we have combined the advantages of speed with the flexibility of propeller operation. New and better propellers have made this possible. A lot of study preceded installation of the Allison T-40 in the *Skyshark* with a pure jet engine as the alternative. We came to the conclusion that with turbo-prop, the A2D could take off in two-thirds the distance, carry a greater payload, fly further, and drop four times as many bombs per gallon of fuel on the enemy than it could if it were equipped with a pure jet powerplant."

The A2D is a new airplane of the long line of attack and dive bombers that have flowed continuously from Douglas production lines for the past 20 years. Its immediate predecessor is the AD *Skyraider*, a Navy attack bomber still in production and in rugged, everyday use in great numbers with the Fleet. The new *Skyshark* attack bomber is the outcome of prolonged efforts to improve the AD to a point where its speed and range would permit it to operate unescorted, and defend itself against jet fighters.

Preliminary studies along this line, while resulting in many improvements in the basic AD model, indicated that at least twice the power available in the AD would be needed to raise its speed range to the jet fighter class. Pure jet engines were considered, but no jets were available that would give the A2D a short enough take-off to operate with maximum load from a carrier's deck. Nor would pure jet provide the necessary tactical range of operation.

Concurrent development of the Allison T-40 gas turbine engine under Navy sponsorship was the answer to the problem. The T-40, with improved contra-rotating propellers and delivering 5500 horsepower, would place the speed range of the A2D in the jet fighter class. Static thrust, inherent of propeller operation, would get the airplane off from a small carrier's deck with a maximum bomb load. The dual engine arrangement of the T-40 would permit single unit operation at low altitudes for maximum efficiency and range. The contra-rotating props would offset the propeller torque and ease critical carrier deck landings.

It was originally intended to use as many AD parts as possible in the new A2D. But it soon became apparent that the ever-changing strength, stability, and equipment specifications, resulting from the almost doubled engine power, would necessitate many changes. Though the wing area and span remained the same, wing and tail surface thicknesses were decreased, landing gear strength and stroke were increased, and structural strength was added. Despite these changes, the family characteristics carried over from the AD can be clearly seen in the wing planform, tail configuration, landing gear arrangement, and cockpit.

In the general arrangement of the A2D, every consideration is given to pilot safety and efficiency of operation. The cockpit is located as far forward as possible and provides exceptional downward vision. It has also been greatly reinforced against crash loads. An upward jettisoning seat for high-speed escape had to be used instead of the bottomside bail-out chute recently developed for the Douglas F3D, due to location of the engine directly beneath the pilot.

The cockpit canopy of the *Skyshark* departs from the conventional blown-bubble type, and was designed to permit the use of single curvature laminated plate glass. The strength of plate glass, rather than plastic, was considered necessary to cope with hot day, sea-level, full-throttle operating conditions. Cockpit cooling is provided by an air expansion turbine system.

Engine starting, a difficult problem in conjunction with all turbine-type engines, received considerable study. This problem was aggravated by the fact that in the A2D, it was required that the T-40 could be started without the assistance of an external ground power supply. Self-contained electrical batteries for this purpose would have proved too heavy. Final solution was installation of a new-type auxiliary power unit. This APU unit was designed and developed by AiResearch Corporation and is a combination of a small gas turbine and air turbine starter. It provides the pilot with a push-button automatic starting system of low weight, and materially reduces engine starting time, an important factor under combat conditions.

"While security regulations do not permit divulging performance details," Heinemann says, "it is gratifying to note that the bomb load per mile per hour of the A2D is almost 50 per cent greater than that of its predecessor, the AD, while fuel consumption per pound of bomb per mile is substantially the same as that of the AD piston-engine airplane. This comparison is considered of great significance inasmuch as it indicates a great improvement in performance efficiency. A similar comparison with jet engines indicates that contemporary jet airplanes consume four times the amount of fuel in accomplishing a typical A2D mission.

DOUGLAS *Skyraider*, forerunner of the A2D, carries 14 rockets. Note its dive brakes

"The A2D *Skyshark* is unique in its combination of an extremely short take-off, an unusually high operating altitude, a high-speed approaching that of jet fighters and high load-carrying ability which makes it well suited as a general purpose, carrier-based attack or ground-support aircraft."

Because of this speed and range, Heinemann points out, the A2D will be able to perform combat missions with or without jet fighter escort. Offensive punch of the new airplane is delivered by a variety of rockets, bombs, aerial torpedos or other weapons carried on external wing racks. Striking power of the A2D is described by the Navy as ". . . ideally suited to air support of amphibious troops as well as to attacking targets at sea."

Equipped with folding wings and arresting hook, the *Skyshark* will operate from the deck of the smallest carrier. The same short take-off run will enable it to operate from short, quickly constructed runways in forward combat areas. The ease with which armament may be changed on the external wing racks, alternating from bombs to rockets or to radar packages for search work, and to other implements of combat, illustrates the built-in versatility of this new craft.

From the military logistics standpoint, the A2D stands out above both reciprocating and pure jet-powered aircraft. It requires less fuel than a jet for similar performance. The T-40 is a simpler engine to maintain than previous reciprocating engines, and fewer spares will be required in forward combat areas. The relatively small size of the T-40 powerplant makes it less vulnerable to enemy firepower.

Just where the turbo-prop will end up in the military picture hinges less on turbine-engine development than upon the development of propellers to efficiently utilize the tremendous power that the gas turbine makes available. Propeller efficiency has improved greatly during the past several years. One expert states that a high-speed propeller that will operate with 70 per cent efficiency at 40,000 feet and at speeds from mach .85 to mach 1, will permit turbo-prop airplanes to compete with jets on an equal footing. Studies are already well advanced toward development of a prop of this type.

Nor are supersonic propellers beyond the realm of the possible. It has been proved that supersonic airfoils are practical. It is logical to assume that adaptation of these airfoils to propeller design will happen in the due course of time. If and when such props are available, it is logical to predict a sharp swing from pure jet to extended use of the turbine-driven prop.

The new Douglas A2D *Skyshark* will be watched with intense interest by military personnel. Besides being a good substantial and workable airplane, it is pioneering in a new direction. It has already shattered the all too popular opinion that turbo-prop is an interim design bridging the change-over from reciprocating power to pure jet. It is well on its way to establishing turbo-prop power on a plane of efficiency that neither reciprocating nor jet, in its contemporary form, can hope to achieve.

Packet Package

(*Continued from page 21*)

completely off the fields. They slowed things down too much and got in the way.

"This time we'd know better.

"The thing is," he explained, "it isn't a matter of getting the airplanes here. They could be flown here from any point on the globe in 50 hours. But it isn't the airplanes that matter. It's the bits and pieces. It's the spare parts that keep the airplanes in the air. So an operation like an airlift depends on the bits and pieces."

If that phone call came, General Alexander would have two groups of troop carrier, or transport, planes to start flying the "stuff" up there. One of them, the 61st Troop Carrier Group (Heavy), consists of C-54's, the workhorse airplane of the lift. The other group, the 60th TC Gp. (Medium), flies C-82's, the famous Fairchild *Packet*.

For the old Berlin lift, the C-54 had one big advantage—there were enough of them to do the job. But because of their height from the ground and because everything had to be put into the side door, they were awkward to load. Still, they flew at 170 mph, and they carried 10 tons apiece.

Alexander said they have roughly the same advantages or disadvantages in the troop carrier field. C-54's are big and will pick up a lot of weight, but the difficulty of loading prevents them from carrying any equipment larger than a jeep and trailer—and even a jeep has to be loaded on a special ramp.

Although the 61st Wing now is strictly a troop-carrier outfit, Alexander expects to keep his *Skymasters* indefinitely.

"I still have responsibilities in Lebanon, carrying United Nations personnel around," he explained, "and we are called on occasionally for trans-Atlantic flights.

"We also do all the medical evacuation in Europe, including Trieste and England. We bring the sick here to Rhine-Main Air Base, and then MATS flies them home.

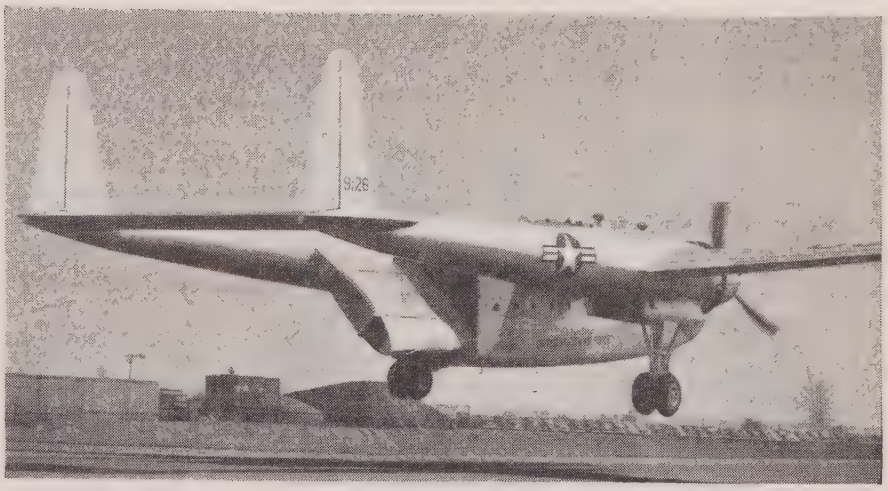
"And then," the general continued, "we support the tactical unit here, the 2nd Air Division. For example, when they go on a gunnery training mission down to Wheelus Field in North Africa, we fly their food, ammunition, spare parts and ground crews down for them.

"The C-54 is good for all that, and we also have used it a couple of times to carry troops around."

The C-82, however, is an airplane which was tailor-made for troop-carrier operations. From the moment it was thought up, the design was for implementation of the troop-carrier mission: 1.) To carry and deliver paratroops and their equipment; 2.) to transport troops and equipment to front-line positions; and 3.) to resupply these units, either by parachute drop or by landing supplies.

The *Packet* is a big ship, and it looks awkward, sitting on the ground. It looks as though it ought to waddle when it taxies out to take-off. But it gets off the ground fast, and once it's airborne and the size of that tremendous "box" fuselage comes into perspective, the C-82 is a pretty good looking aircraft.

Pilots like it. One First Pilot from the 60th TC Gp., a captain with more than 300 hours in the *Packet*, said it was a good ship to handle. He said it was maneuverable and good in formation flights, the key to troop carrier success. There is good visibility from the cockpit, and the twin vertical stabilizers and the big horizontal stabilizer give the plane quick reaction to the controls.



USAF PACKET, this one a Fairchild C-119, hauls a spare wing, with root end protruding

"I'll tell you one thing about this plane that's hard to learn though," the captain said, "and that's how to land it. There's a negative stagger to the wings of 3° and a positive stagger to the 'box' of 4°. That means you have to come in with the nose high. It's hard to get used to."

He pointed to a *Packet* that was landing on the runway a couple hundred yards away. "See what I mean?" he asked.

And it was easy to see. When translated into English, the "stagger" added up to a 7° up-tilt to the nose of the airplane with the wings parallel to the ground.

The pilot landing touched down featherlight on the rear wheels of the tricycle landing gear, but the rear end of the fuselage almost touched the ground before he put the nose down on the front wheel.

"Bad landing," the captain commented. "He must be new. It's hard to get used to, but if he had a full load and did that, he and the co-pilot together on the control column wouldn't have strength enough to keep it from coming back down too hard on the nose wheel. You have to come in with the nose high, but you can't leave it up."

The stubby aircraft with the twin tailbooms—they call it a "pregnant P-38"—made its debut in USAFE (U.S. Air Forces in Europe) during the lift, when five of them were assigned for special missions. They flew parts in for a new Western Berlin generator plant, heavy engineering equipment to make new runways, and other bulky loads. They came back down the narrow corridors with crated goods too large to load into the side doors of the C-54, automobiles or military equipment.

During the lift, they took the big clam doors entirely off the rear end of the *Packets*, and the ships would pass overhead with the bumper of a jeep or the uprights and prongs of a fork lift, too high to be pushed all the way into the "box," hanging out in mid-air.

In those days, the C-82's generally flew singly. Now people in the U.S. Zone of Germany seldom see fewer than three at a time, always in that standard V formation, keeping trim, in training.

For, as General Alexander said, the peacetime mission of any military force is to be prepared "if the whistle blows."

And that is what they are doing in the 61st TC Wing.

A troop-carrier wing is not going to do much good without troops and equipment to carry, so the 61st works closely with the ground forces in the European Command—the occupation command—to make sure the troop-carrier boys understand the problems of the doughfeet and the ground characters know some of the problems involved in "driving" an airplane.

To that end, an Air Transportability School was set up at Furth Air Base, just outside Nuremberg. To it went a picked group of infantrymen who were to be trained as teachers for their units, and an equally picked group of flyers.

The infantrymen learned everything from how to put on a parachute to the proper way to find the center of balance of a jeep. The airmen, in turn, found out that a lot of the weight involved in transporting the fighting infantryman comes from such mundane things as water for him to drink and food for him to eat, as well as fancy weapons and lots of ammunition.

The avowed mission of the school was to "train air and ground forces in their combined ability to move by aircraft with such equipment as may be necessary to accomplish a mission or landing."

But they had to start right at the beginning. First there were lectures on the capability and limitations of transport aircraft, and from there they went into the tying of knots for lashing down cargo. They learned how to compute the CG of any vehicle or artillery piece, and then, working with a model of a C-82 mounted on a pivot, the infantrymen learned how to load it with model jeeps and trucks and guns so that it balanced.

For example, a 105-mm howitzer can be backed into a C-82 by a three-quarter ton truck so that the howitzer is forward of the plane's center of gravity and the truck to the rear, thus balancing.

Then they put the men aboard. A C-82 will carry 41 men with their equipment, and the doughfeet had to learn about parachutes and how to fasten a safety belt and what position, if any, is comfortable on a bucket seat.

When they finished on the ground, the

(*Continued on page 42*)

Packet Package

(*Continued from page 41*)

whole 1st Bn., 18th Infantry Regiment, part of the famed First Infantry Division, loaded into the troop carriers for a practice mission. The 61st Wing took the whole battalion, with ammunition, fuel, food and water for one and a half days. They flew from Giebelstadt, an air base near Wurtzburg, to Rhine-Main Air Base, and put up a perimeter defense around the base. It was good practice for both air and ground forces.

However, that is only half the mission of a troop-carrier unit. The other half is parachute operations—both troops and supplies, from a jerrycan of water to a two-and-a-half-ton truck.

And that is where the C-82 shines again. For it was built expressly for such operations. There are even two small doors in the rear of the plane, but there is a special exit for paratroopers. The exits, fitted into the big clamshell doors where they taper to a point, are thus out of the most forceful part of the slipstream. They hinge into the aircraft, and thus may be opened and closed during flight.

This is another place where the high tail on its long booms comes in mighty handy. It is out of the way of that double stream of men pouring out their jump exits. They don't have to worry about it at all. Here, also, is where formation flights are needed, and where practice in formations flying pays off. The *Packets* cruise almost as fast as a C-54, but a man can't jump comfortably from a plane going more than 130 mph. That means a slow-down of around 40 mph before the troops can hit the silk, and getting a whole flight of big planes to slack their speed together is no mean trick. They must stay together so that the men land in groups sufficiently large to fight effectively, but it is difficult. One of the training missions of the 61st is to lick that problem.

Dropping "paratainers" (parachute containers) is a good deal easier. In fact, it is practically automatic. The *Packet* is one of the few non-bomber aircraft with a bomb bay—a trap door in the bottom of the fuselage. Along the ceiling of the fuselage is a track, and on the track are 15 hooks for paratainers. When the navigator gets the plane to the target, and the pilot has brought it down to about 300 feet above the ground, he signals the flight engineer who is standing by some switches in the rear of the plane.

All the flight engineer has to do is crank open the bomb bay doors and push a switch. The rest is electric. A little electric motor pulls the paratainers along the track and drops them out the open door in the belly of the plane, alternating a bundle from the rear with one from the front to preserve the plane's balance. If the flight engineer punches the "salvo" button, all 15 paratainers are away in a few seconds. For emergencies, there is also a "salvo" switch in the cockpit.

Unloading a two-and-a-half-ton truck is a little more complex. To begin with, the truck has to be driven up two narrow tracks—and each plane carries its own set of ramps—to the deck of the plane, itself just the height of a two-and-a-half-ton truck bed. The vehicle is run in on special platforms in the plane. These are fitted with wheels like roller-skate wheels, and serve two purposes: to distribute the weight of the truck so that there are not just six points of stress, under the three sets of wheels on the deck of the *Packet;* and to make for smooth unloading. The truck is then lashed down, and its three 100-foot parachutes hooked up to the static chord.

The "box" of a *Packet* is only four inches wider than the six-by-six truck, so everything has to be loaded just right. The clam doors are taken off for an operation like this one, for they cannot be opened in flight.

When the pilot gives the sign, the lashings are untied, and the truck slides out the back of the plane on its wheeled platform. With luck, it lands lightly on smooth terrain, and the ground forces jump in and drive it away. Just like that.

The C-82 can carry anything up to a 17,500-pound 75-mm halftrack. That is the heaviest authorized load. Maximum gross weight of the plane is 54,000 pounds, and the maximum distance it can haul such a load is 1,300 miles.

The *Packet* can take off on a runway from 1,800 to 2,000 feet long, though the pilots don't like to, and it can land at 100 mph in about 2,500 feet. Everything on the plane, which has a wingspan of 106 feet and an over-all length of 77 feet 1 inch, is electric except the brakes. These are hydraulic. The electric fittings save a lot of weight, but they also constitute a terrific drain on the generators—so much, in fact, that an auxiliary gasoline generator is started up before landings and take-offs.

The cockpit is huge. In fact, one pilot said he sat so far away from the co-pilot he practically had to have a long-distance telephone to talk with him. Besides pilot's and co-pilot's places, there is a navigator's equipment and table and a radio operator's seat in the cockpit, which is reached by climbing a six-foot ladder from the cargo to the flight decks.

The *Packet* is fitted out with the latest in flight and navigational aids. One feature is a "hot wing," hot air conduits along the leading edge of the wing and tail which prevent icing. Navigational equipment naturally includes radar and LORAN (Long Range Aid to Navigation), an electronic system of determining position. There are two radio compasses, manual and automatic, and the usual VHF and HF receivers.

Pilots say the aircraft is one of the best they know for GCA landings. The "drivers" also like the extremely flexible airspeed of the C-82 for flights in turbulent weather. It can vary as much as 70 mph, from 140 to about 210 mph.

The plane also is fitted out to tow two gliders.

Maximum service ceiling of the *Packet* is 19,000 feet. According to experienced pilots, the best ceiling is about 5,000 feet, the maximum range with standard gasoline tanks is about 2400 miles, as contrasted with approximately 2000 miles of a C-47. Endurance record for the *Packet* is a surprising 24 hours with only normal tanks and no refueling.

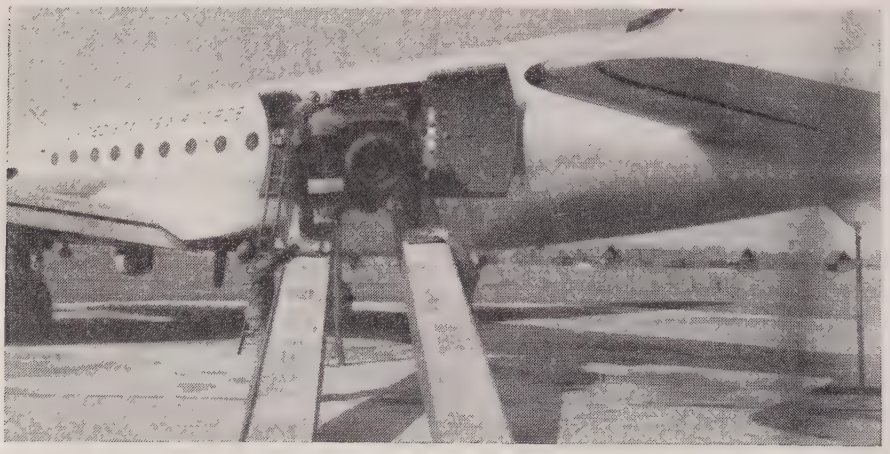
Maintenance, however, presents a few problems, mainly those inherent in its design and unavoidable. For example, the *Packet* is thin-skinned to save weight, but that spells added sheet metal work for the ground crews on account of vibration. The engines of a high-wing plane are naturally harder to get at than those of a low-wing plane. And, of course, since landing gears generally let down out of wells located out in the wings, a high-wing plane has more landing-gear troubles than a low-wing craft. That is unavoidable, if only because the main strut has to be longer, thus presenting more leverage on its wing support, and therefore increasing the stress on the whole landing-gear system.

Alexander, who comes from Watseka, Illinois, and who has been with transport outfits since the Ferry Command was established in 1941, believes that airplanes should only be flown the exact number of hours necessary to keep crews in top shape. As he sees it, any Air Force outfit, except the Military Air Transport Service (MATS, operated jointly by the Air Force and Navy), which flies its aircraft more than that minimum training time is wasting the Government's money. They not only are burning up fuel needlessly, but are wearing out expensive airplanes and increasing maintenance costs. The 61st is not doing that.

"These planes may be replaced over here as we develop new aircraft (such as C-119)," the general said, "but if the maintenance is kept up and they aren't abused, you'll see 'em flying 10 years from now."

Replacements or not, it won't matter what kind of planes the 61st TC Wing is flying. They already have made three switches in two years, from C-47's to C-54's to C-82's. Brig. Gen. Edward H. Alexander has the outfit now at peak efficiency. And the general, who once threw bombs out the side door of a C-47 over the famous Hump, intends to keep it there.

AIR FORCE C-54, the workhorse of the Berlin Airlift, carries plenty, but is difficult to load



Daniel Boone Was A Piker

(*Continued from page 18*)

eeks and includes over 60 hours of flying on approximately 70 issions. Then you're only beginning to become a flying Daniel oone.

The course breaks down into air-to-air firing, high-angle strafing, w-angle strafing, dive bombing, skip bombing and rocket firing. early half of the training course is spent in air-to-air work.

The main problem in accurate air-to-air firing comes from hooting out of a turn where the airplane "loads up" with 4 to 6 's. The bullets tend to travel away from the turn and you must earn to compensate for this in your sights. In a tight left-hand urn, the bullets will fire low and to the left of the bull's-eye on he gunsight. While some sights correct part of this error, a pilot nust learn to lead his target just as though he were shooting ducks vith a 12-gage shotgun.

For practice, a standard 90° high side approach is used. The ighter plane starts his attack from 4 or 5,000 feet above the target nd a mile and a half or two miles out. With the airspeed slowed own to 200 mph Indicated at the start of the gunnery pass, we vill indicate 380 to 400 mph when we're in firing range on slightly ess than full throttle.

The proper approach is to roll over into a descending turn oward the target. This gives the pilot behind you a chance to ull up and over you before starting his pass.

If you're out of range when you touch the trigger, there'll be no its. For every hundred feet of error in range, there will be a 12½ eet of lead or lag on the target. If you fire from 100 feet too far way from the target, your bullets will go behind the aiming oint. If you're too close, they go ahead of it.

A good pursuit curve is the key to accurate aerial gunnery. If ou're going to knock anything out of the sky, you must keep that bject in your sights long enough to do some good. When your arget is moving, you've got to turn with him and shoot out of a urn. It takes plenty of practice to make that curved approach ome out right every time.

If your plane is slipping or skidding, the bullets will tend to ollow the flight path of the airplane instead of the sight line. If ou're mushing from slow speed, the bullets again will tend to ollow the path of the airplane and, in aerial firing, to underlead he target.

From 3½ to 5 G's are the best bet in flying a smooth pursuit u.ve. If you pull over 6 G's, you tend to underlead the target nd get a rough sight picture because you're on the verge of stall- ng out in your turn. In these fast turns, you will do a much bet- er job if you are seated properly in the airplane.

When rockets were first put on fighters during the last war, hey were mounted in tubes to assure accurate firing. Later these were cut down to firing rails. Now the rockets are merely clipped o the wings with two break-away fasteners, because tests have roved the rockets take up the path of the airplane at the time f firing. When a rocket is launched, its initial trajectory will be dentical with that of the aircraft, but once launched, it will nove in a reasonably straight line rather than on a curve pre- letermined by the aircraft.

There are a number of tricks in this trade of accurate firing. For instance, the guns are normally mounted parallel to the axis f the fuselage. They should "harmonize," with a gunsight at bout 1,000 feet. By harmonizing, the bullets pass through the arget center when the sight is pointed directly at the target. At ,000 feet, the bullets are still going up slightly and at 2,000 feet, hey re-cross the line of sight.

In the F-51's and other wartime fighters, the guns had to be et so that they would pinpoint at 1,000 feet or closer. With guns nounted outboard on the wing panels beyond the radius of the ropeller on a conventional (old-fashioned) aircraft, the guns are ore-sighted to converge on the target at whatever distance the ilot desires.

With present-day jets, there isn't that problem. The guns on he F-86 are mounted on each side of the pilot within 30 inches f the sight line. I'm actually sitting between six guns in my -86.

The newer jets are much more accurate than the "paddle jobs" ecause there is no torque correction necessary in jets. So long s you're not crowding Mach 1, the ships fly perfectly smooth nd make an excellent gun platform. As you dive and approach Mach 1, the airplane becomes stiff and (*Continued on page 45*)

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TRAIN IN MIAMI -- AIR CAPITAL OF THE WORLD

Jet for Lightplanes

(*Continued from page 23*)

average turbo-jet engine (one to two pounds of thrust per pound of engine weight) is already lower than all piston engines (on a thrust to weight basis) which perform at 150 mph or more. Fuel consumption, however, is still comparatively high for the jets at the lower flying speeds. If it could be reduced by about one-third and the engine lightened the same degree for the same thrust, jets would lead the piston engine in payload performance at all cruising speeds above 125 mph. This reduction in fuel consumption can be had with a 15 per cent increase in combustion (thermal) efficiency, and present development work points toward substantial increases in this direction.

A concerted effort by several engine manufacturers in this country and abroad with an eye to the private-flying market has resulted in the development of a number of small jet engines which may be the forerunners of tomorrow's jet power for private flight. While these engines are not economically adaptable to any of the present types of lightplanes, it is conceivable that, with further development, we may see them or their offsprings applied to the heavier private plane, for flight in the 150- to 300-mph range.

Before describing these small jet engines, let us examine the types of jet devices available today for flight propulsion to see which is most likely to appear on the jet-for-private-flying scene. There are four basic types of jet powerplants available today for the propulsion of aircraft. These are (1) the turbo-jet, (2) the ram jet, (3) the pulse jet, and (4) the rocket. The first three engines breathe atmospheric air for their operation, whereas the rocket has its oxygen supplied by the propellant it carries.

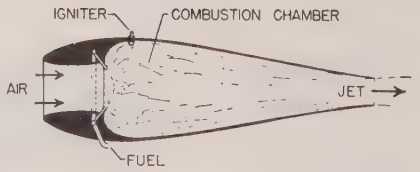
Taking the engines in reverse order, we see that the rocket is generally designed to produce a large amount of thrust over a short period of time. The average V-2 altitude rocket, for example, takes less than 4 minutes to reach its ultimate altitude (100 miles or more up). Its fuel supply is consumed in the first minute of flight.

Thrust is created in the rocket by the rapid expansion of hot burning gases and their ejection rearward through an exit nozzle. At lower flight speeds, the rocket has its greatest application as an auxiliary power boost. It is utilized as such today in the form of RATO (rocket-assist take-off units). Tests are being conducted at present by the government with JATO (jet-assist-take-off) and lightplanes to shorten take-off runs. The rocket could also be applied as an emergency power boost in flight in the advent of a stall at low altitudes or to get the pilot out of other tight situations.

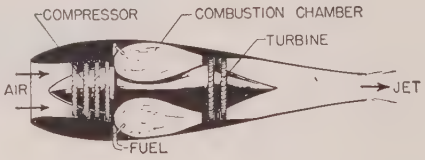
The pulse-jet engine was first introduced by the Germans during World War II as a powerplant for the V-1 Buzz Bomb, and has since been applied in this country to guided missiles and helicopters. The engine is simple in design and can be operated at low flight speeds. Its fuel consumption is quite high at lower speeds, however, and its efficiency increases with flight velocity.

Operation of the pulse-jet engine consists of a rapid series of combustion cycles or explosions (in a combustion chamber), each

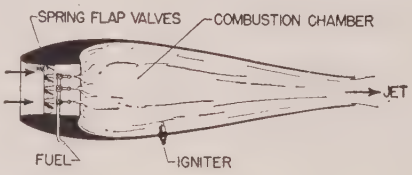
RAM JET



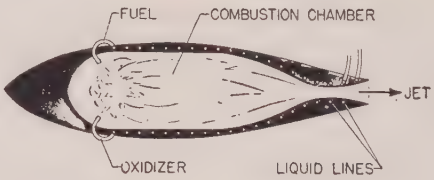
GAS TURBINE JET PROPULSION



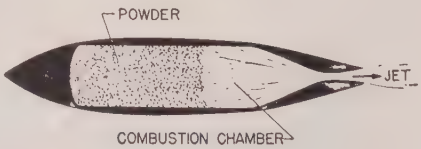
AEROPULSE



LIQUID FUEL ROCKET



POWDER ROCKET



of which ejects a mass of gases rearward out of a tailpipe to produce thrust. Atmospheric air enters the engine through a valve bank where it mixes with a continual spray of fuel. The mixture is then ignited and the resulting explosion closes the valves so that the gases can only flow rearward. The cycle is repeated after the explosion when the valves open again to admit a new charge. All this occurs at a rate of 50 or more cycles per second, depending on the design and size of the engine, so that operation appears as a steady blast to the observer. This blast is one of the factors which limits the commercial applications of the engine at present since the accompanying noise of operation would be an annoying and objectionable factor when flying in or near residential areas. Attempts to muffle the noise have met with some success at a reduction in thrust.

Pulse jets have been uniquely and successfully used on the tips of helicopter rotor blades where the rotational velocities attained are in the range of economical operation of the jets. Marquardt Aircraft Company of Venice, California is at present developing a pulse-jet helicopter which has flown successfully and handles nicely. The jet 'copter has good stability, turns easily and offers less vibration than the conventionally powered helicopters.

Jet helicopters have a number of other advantages over those which are driven by the conventional piston engines. They are lighter, since the mechanical transmission and heavier engine are eliminated, and are simpler in construction. Torque is eliminated due to the mounting of a jet at each blade tip. This does away with the need for an anti-torque propeller or an extra set of rotating blades. It is estimated that the pulse-jet powered helicopter outstrips the conventional 'copters in payload performance (total payload to gross weight) for all flights under 3½ hours. For the first two hours the pulse-jet helicopter will carry 50 per cent more payload than the piston-engine 'copter. This does not consider fuel consumption which, at present, is higher for the jet-propelled 'copter and causes it to lose its payload advantage above 3½ hours due to the additional fuel needed.

Ram jets, next on our list, require high flight speed before they can operate properly. The engine consists merely of a shaped tube, open at intake and exhaust ends, in which fuel is burned and expelled rearward to create thrust. A pressure wall, built up at the intake end by ram air, prevents combustion from proceeding in that direction and is a necessary prerequisite for operation. Fuel is injected through nozzles in the combustion region, mixes with the intake air and is ignited. Flame 'blow out' is prevented by the use of flame holders or gratings located in the combustion zone.

The ram jet, by the very nature of its operational requirements, cannot be operated at lower flight speeds and produce thrust. Like the pulse jet, it has been applied to rotate helicopter blades by situating jets at the tips which normally travel at velocities in the efficient operating range of the ram jet. A successful ram-jet helicopter with an 18½-foot blade diameter has been developed and tested by McDonnell Aircraft Corporation, of St. Louis. This 'copter, tagged "Little Henry" by the engineers who developed it, is virtually a flying motorcycle for the Air Force. Both ram-jet units weigh a scant 10 pounds each, a fraction of the weight of the conventional piston engine which power most of today's operating helicopters. "Little Henry" has additional advantages over conventional helicopters. Torque is completely eliminated since the jet force is generated at the point of application. This also means an additional saving in weight by the elimination of driving mechanism and gear boxes. The designers of this first ram-jet helicopter foresee where it may develop into a commercial mode of transportation,

(*Continued on page 46*)

Dan'l Boone...a Piker

(*Continued from page 43*)

hard to hold on the target. For that reason, you can shoot a more accurate pattern at speeds of about 400 knots at medium-high altitude.

On-the-deck strafing at ground targets is normally done in practice at reduced power. Speeds are still plenty fast and the target looms up in an awful hurry. In practice gunnery, there is usually foul line 800 feet on the short side of the target to discourage over-eager pilots from coming in too close.

The ground target is a cloth-covered frame, 10 feet square. It is inclined 20° from vertical to make it appear nearly square in the sights of the firing plane. Entry altitude is 1500 feet above the terrain for practice. Indicated speed at the beginning of the run is roughly 250 knots and the dive is only about 10°. The training manual says that 50 feet is the minimum altitude for pull-out at 350 knots.

It is surprisingly easy to fly into a ground target. A close friend of mine went right through a target in an F-80. He scratched up the airplane a little, but was able to fly it home. Later he explained it this way:

"I'd just bore-sighted my guns and was trying them out for the first time. I came in low on a fast pass and could see the bullets chewing right into the target. It looked so good that I just came in a little closer for a few extra rounds. Then—wham!—I took down the target, frame and all."

At the annual Las Vegas Gunnery Meet which our team won a year ago, all ground firing was done without a foul line and at the pilot's discretion. The meet this year had an 800-foot foul line and the pilot was fined 10 per cent of his score for his first over-run of the foul line. If he came in too close on another pass, he was disqualified.

In the same contest, dive bombing was limited to a minimum of 2,000 feet and rockets were disqualified if they were fired closer than 2,000 feet from the target. Normal rocket release altitude is 2500 to 3500 feet—to be tactically practical. Spotters on the ground tracked the competing planes with computing transits and disqualified the pilots who went below minimum altitudes.

Our team had a wax pencil line on the cockpit canopy calibrated for 20° and 40°. When that line was parallel with the horizon, we knew our angle of dive and could fire that much more accurately. That's a home-made system and certainly isn't considered to be as accurate as some of the compensating sights, but it gave us just one more check point.

Many a pilot checks his angle of dive by putting his head against the side of the canopy, making the target barely visible along the canopy rail. Then he'll begin his diving turn. It takes 16 seconds to come down from 11,000 feet and arrive over the 150-foot circle used for dive bombing. That gives 6 to 8 seconds of straightaway dive in which to line-up on the target. In practice at least, dive flaps are not used except for emergency recoveries.

A pilot I know was firing his first rockets one day on a Navy range on the East coast. He came in too low and fired into the muddy surface of the range—and then flew right into the geyser of mud that mushroomed up. He got back into the field okay, but the airplane was sure a mess.

A number of the teams entered in the Las Vegas meet were working at a disadvantage. The teams from Japan and Europe had little opportunity for repeated practice over established ranges and teams stationed on the East coast were also at a slight disadvantage. Even though our team had ample time allotted, we were unable to practice very much because of "old man weather." You can't fire out over the ocean unless visibility is such that you can see the surface and there aren't many days of good visibility during the early spring over the Atlantic seaboard. However, that makes it just that much more of a challenge to do a good job when you do shoot.

This air gunnery is essentially a young man's game—up to about 30 years. True, you'll see many a Lt. Colonel or Colonel with a patch of silver in his hair behind the controls of a fighter, but usually these men come into administrative jobs and spend more and more of their time behind a desk. Then too, the pull-outs are sometimes rough on a pilot's body. Most pilots use G suits, but you can tense your muscles and bend down to fight off blacking out up to about 6 G's over a short period of time without one. Actually, due to inherent muscular tension, most pilots are able to hold a more steady aiming point when applying a slight pressure on the stick.

When you're figuring your sighting in mils (an angular measurement which, projected 1,000 feet into space, covers one foot), you've got to have good eyes and a fine sense of timing. Only practice will sharpen these senses. Almost any active sport—football, baseball or basketball, will help develop basic coordination. After that, you simply learn by doing.

A good fast fighter plane like the F-86, coupled with those six guns and a trained pilot, can do a mighty efficient job of sky-cleaning. They're so accurate they make Daniel Boone take a back seat.

HEAR NO EVIL

Although it's wise to avoid malicious gossip, only a monkey shuts his ears to reality. And cancer is a grim reality. We must open our ears to the life-saving truths which will teach us and our neighbors the safeguards against cancer. For humanity's sake—and our own preservation—we must support the crusade against this mortal enemy of man.

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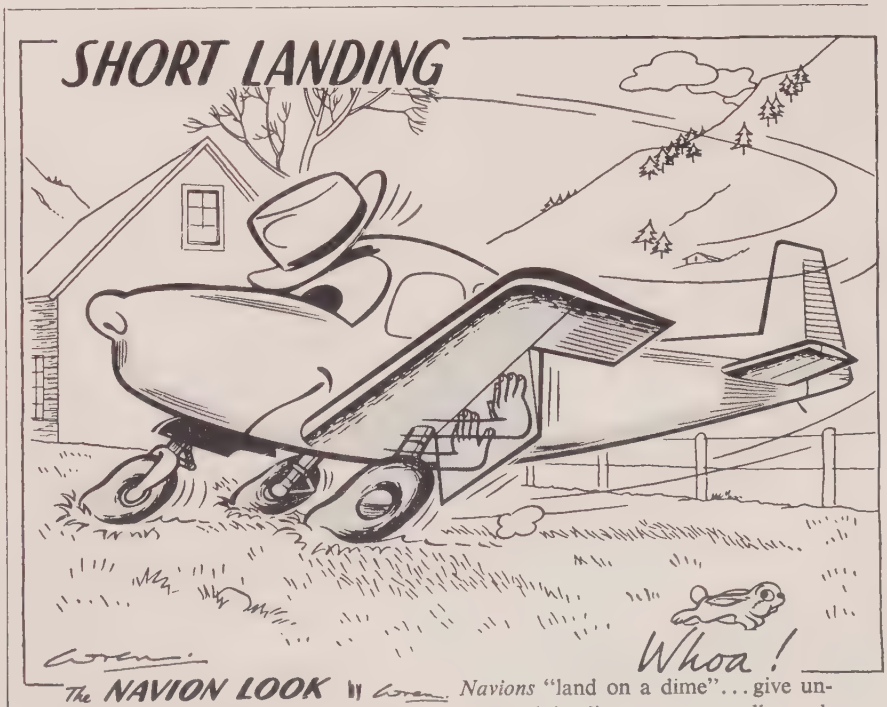


The NAVION LOOK by Ryan *Navions* "land on a dime"... give unmatched short field performance...pillow-smooth landings even on small, rough fields in cross-winds.

Jet for Lightplanes

(*Continued from page 44*)

perhaps for shuttle hops between air terminals and civic centers. Private application is still a matter of speculation due to the present high cost of operation.

The gas turbine or turbo-jet engine as it is usually called appears at the present time to be the jet most adaptable to private flying. It is the most complicated of the four types from the standpoint of moving parts though it has but a fraction of the total number of parts found in an average piston engine. One particular small gas turbine, for example, has less than one-sixth the number of parts of a comparative class of piston engines.

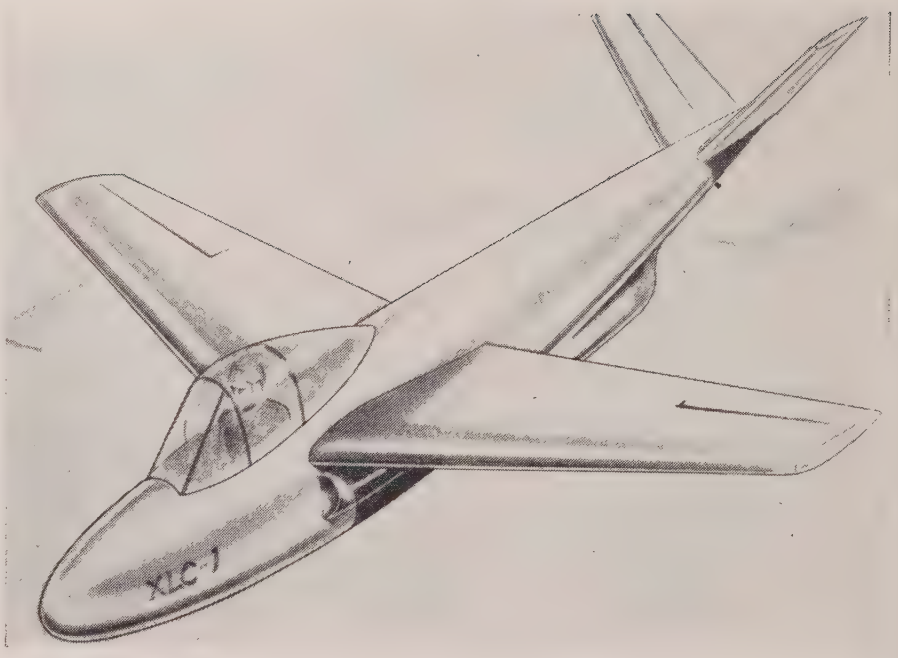
The gas turbine is noted for its smooth operation, compactness, simple and light construction. It is practically vibrationless and operates at relatively high shaft rotational speeds (20,000 to 40,000 rpm).

A good way to describe the operation of a turbo-jet is to trace the path of air through the engine from intake to exhaust. Air enters through an intake cowl or duct from the atmosphere and flows into a rotary compressor where its pressure is increased. Passing through the compressor, it is next forced into a combustion chamber where it mixes with a fine spray of fuel from a pump-fed nozzle. The mixture is then ignited and expanded through a turbine where part of its energy, released as heat, is used to drive the turbine. The turbine in turn is coupled to the compressor which it drives. The hot gases, after leaving the turbine, are next shot out the tailpipe at high velocities to produce thrust.

Thrust is regulated in the average turbo-jet engine by varying the tailpipe exhaust area through the use of a 'bullet' or tail cone which moves in and out of the exit and under the control of the pilot. This regulates the flow of gases through the engine and hence the thrust.

Several attempts have been made, mostly by training schools and private groups, to develop an inexpensive and lightweight gas turbine but of government surplus engine parts. A small aircraft turbo-supercharger, for example, is an excellent source of ready-made parts around which to design a light gas turbine. A small (240 pounds thrust) turbo-jet presently is being completed by students at the Cal-Aero Technical Institute for possible application to the private plane. An all-metal personal plane has been designed for the engine and is under construction. This plane is a one-place mid-wing monoplane with a V-tail. The jet engine is mounted behind the pilot, with its exhaust below the fuselage.

H. G. Nicholson, director of training at Cal-Aero, estimates that the one-placer will have a top speed in the neighborhood of 250 mph, cruise at slightly less than that, have a range of over 300 miles and a fuel consumption of about 75 gallons per hour at cruising. This is considerably higher than a comparable prop-driven airplane and would, therefore, put it out of reach of many pocketbooks and label it as a poor economic investment if produced. The designers of the craft, however, foresee possible use of the lightweight jet airplane as a target drone for military work, having certain definite advantages over currently used drone craft.



CAL-AERO TECH students designed and are building this jet-powered lightplane shown here in the sketch. Note plane's sleek lines and its "Vee" tail, air intake under wing

The first large company in this country to produce a lightweight gas turbine for aircraft use was Boeing. Development work on the lightweight jet was started at their Seattle plant during the war. Two models were completed in 1947 as part of a long-range development project. One, the Boeing '500', a turbo-jet, weighs just 85 pounds stripped of all accessories and produces a top 150 pounds of thrust. The other turbine, Model '502', is a turbo-prop engine which delivers 200 shaft horsepower and weighs 140 pounds. The exhaust gases of this turbine are shot rearward to produce an additional 50 pounds of thrust. Both engines are basically alike in construction with the turbo-prop engine converting most of its energy to shaft horsepower for spinning a prop. To accomplish this, it mounts an extra turbine wheel geared to the propeller shaft.

The Boeing baby turbines are light, compact and extremely simple in construction. The turbo-jet, for example, is a scant 29 inches long with a maximum diameter of 22 inches. Within its 29 inches are packed a single-stage centrifugal-flow compressor of cast aluminum, two tubular stainless steel combustion chambers, a single turbine wheel, 7¼ inches in diameter mounting 64 alloy steel blades, and a stainless steel exhaust pipe at the tail end of the engine.

Gas temperatures in the combusion chamber may run as high as 1500°F at an operating speed of 36,000 shaft rpm. Accessories include an oil pump, ignition coils and spark plugs, accessory drives, fuel pump, heat shields, starter generator, etc. Top weight ready to run is approximately 140 pounds.

France, always a leader in aeronautical development, is vying for her share of the honors in the jet lightplane field with a jet-propelled glider, the Fouga *Sylphe*, formerly the *Cyclone* (see SKYWAYS, April issue). The plane, classified as a jet-powered lightplane by its designers, represents one possible method of solving the present problem of high fuel consumption. When airborne, the pilot can shut off the jet engine and glide for a while if conditions are right. This jet lightplane has been on flight exhibition in the U.S. for several months.

Jet power for the *Sylphe* is obtained from a small turbo-jet, the Turbomeca "Pimène", which weighs approximately 100 pounds and delivers up to 200 pounds of thrust. The engine, a scant 32 inches in length and 16 inches in diameter, develops a top shaft speed in the neighborhood of 35,000 rpm. When it delivers its maximum thrust, 200 pounds, fuel consumption is 1.4 pounds of fuel per pound of thrust per hour. (Compare these figures with the performance of the Boeing "500" turbo-jet.) This 200 pounds of thrust is equivalent to about a 150-hp prop engine delivering rated power to the prop shaft at 200 mph.

The airplane looks like a cleanly designed mid-wing sailplane with the turbo-jet mounted above the fuselage in a streamlined pod directly behind the pilot canopy. A *Bonanza*-type V-tail is employed to permit a smooth flow of exhaust gases from the jet. The plane has a span of 42 feet 8 inches and a length of 20 feet 4 inches. Present flight range under jet power is rather low, being somewhere in the neighborhood of 150 miles on the 26 gallons of gasoline carried in the tanks. This is attained with the engine developing a cruising thrust of about 150 pounds at a lower fuel consumption than at the maximum 200 thrust pounds. Under powerless soaring conditions, this range could be upped considerably.

While jet propulsion for the private flyer has still to become a commercial reality, considerable progress is being made to achieve this end. Future development will, for the most part, pace the advances made in the larger military and commercial jet engines, since the greatest amount of research is being carried out in these fields. With the knowledge accrued from these sources, Boeing or Turbomeca or one of the other lightweight jet engine experimenters, may solve the problem in the not too distant future and soon there may be jet power for personal planes.

Read Me the Road Map

(*Continued from page 37*)

in Kansas City. KC finally won out because of the king-sized restaurant on the field.

Leaving KC, Mitchem groaned, "I never get over the uneasy feeling that I've forgotten something. Every time I walk out to the airplane, we don't have a single sheet of paper—no clearance, flight plan, weather cross section, weight and balance form, fuel load report, radio log, emergency equipment check list, cargo and passenger manifests, long-range cruise-control charts or fuel consumption log. Here we take off with nuthin'. It isn't quite decent—like starting off without your pants."

Our best winds were at 9,000 feet and we cruised over a little low scud between Pampa and the Canadian River. Mitchem made some wisecrack about going "on the gages."

After a quick look at the radio facility chart, I asked, "Why not? You'll never have a better chance to work the gages. Our next check point is the CAA range station at Gage, Oklahoma."

Over Kansas City we had our first radio trouble. We tried a dozen times but couldn't raise the tower. Finally the KC tower operator asked, "*Navion* north of the field, if you read the tower, you are cleared to land behind the airliner approaching from the north."

We landed and had a radio man check our transmitter while the ship was being serviced. The radio worked fine, he told us, the tower just didn't have a receiver tuned on 122.1 mc. So while Mitchem checked the weather, I talked with the tower operator. He agreed to clear us out with one-way instructions.

"If you read me, rock your ailerons," he said as we taxied past the busy TWA shops. We nearly replied, "If you read us, rock the tower," but he wouldn't have heard it anyhow.

If you haven't been into KC recently, you're due for a surprise. Some diabolically enterprising television outfit has erected a hell of a high transmitter tower directly off the south end of the main runway. Even in a little airplane, you start turning as soon as the gear is up.

It was between Kansas City and South Bend that the road map really had a workout. We headed northeast over Kirksville and Fort Madison toward Chicago. It was hot and hazy. Radio reception was noisy. Each town looked exactly like the one we had just passed and all the rivers seemed to have identical curves. Our maps were not quite two years old, but they must have added a lot of railroads in the past 24 months. We finally pulled out our dog-eared Rand-McNally, turned to the page marked "Illinois," and went to work.

It was really quite easy that way. We "drove" along at a comfortable thousand feet and once we found the name of a town on a rooftop, we were in. Mitchem kept one finger on the map as we hopped along from town to town. It's surprising how much of the country you can see that way; country that you've been missing for years in a C-54 at 10,000 feet with your feet propped up on the instrument panel and a detective story in your lap.

The road map even gave the history of the surrounding country. Just like a Cook's tour!

We made South Bend by mid-afternoon and our passengers dropped off to pick up a new car. There wasn't enough daylight to make Reading so we RON-ed in South Bend.

Our third day out of San Diego dawned clear and bright and the "260," minus passengers and baggage, indicated nearly 2,000 feet per minute rate-of-climb across the fence on take-off. The only dark spot in the whole picture wasn't in sight—yet, but it had showed up on the weather sequence. Pittsburgh was reporting a 3800-foot ceiling with lower broken clouds at 1,000. Visibility was 2 to 3 miles with smoke and drizzle. Temperature was 49; dew point 46.

Midway between Akron and Pittsburgh, the wall of fog was plainly visible and the *Navion* indicated an even 200 mph as we came down from 9,000 to 2,000 feet. Out came the road map and N5160K went into the "smoky city" under the weather and with the help of Rand-McNally.

It seems as though just about every pilot who has flown in the east has spent many a weary hour in the Pittsburgh Weather Bureau office. It'd make a fine place for a newsreel theater with shows spaced so that the pilots sweating out the weather could check the teletypes between reels.

Airways traffic control was busy. The icing level was 8,000 and the cloud tops were reported at 13,000. Not bad weather for a four-fan airplane with plenty of instruments and anti-icing equipment. The *Navion* stayed on the ground nearly all day.

"If you don't get out of here today," said the ever-cheerful weather man, "you're not going anywhere tomorrow. See this front coming across over Chicago? It'll be here tomorrow morning and we'll really sock-in tight. You might be able to get out under this stuff if you want to go way south to Roanoke, Virginia—or you might be able to follow the four-lane toll-road under the weather direct to Harrisburg."

Late in the afternoon, N5160K paddled out for take-off and drove down the toll-road Harrisburg bound. According to the road map, there are seven tunnels in that road. We got by the first five, but number six was socked in tight. We were practically within spitting distance, but it was no dice.

A quick 180 took us back to a wider canyon in the Alleghenys. They're really only good-sized hills in the far West, but the Eastern weather is consistently so poor that the area has a reputation of being an aircraft boneyard. We went south to the Potomac River, made a left turn over Martinsburg, another left turn over Hagerstown and then drove up the highway to Reading.

It was nearly dark. The neon signs glistened in the rain, and the Reading tower relayed our message "Ten minutes out. Please advise Aviation Consultants."

R. H. Breithaupt, the Sales Manager who is now using N5160K as a demonstrator, wasn't there. "They won't get here in this stinking weather," he'd reported earlier—and gone home.

When we climbed aboard that westbound four-fan airliner the next day, good old Rand-McNally was still with us. The airline skipper made it okay without our road map and I guess that most of his passengers would have objected if he'd flown the way we did—right along the highway. But it got us there anyway.

Earl Dahl KNOWS

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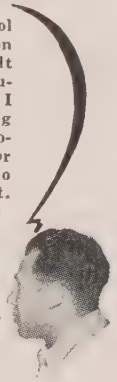
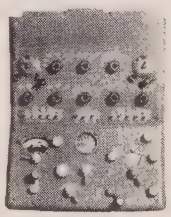
EARL DAHL





Pilot of the busy Beechcraft D18S operated by Rahr Malting Co. of Manitowoc, Wisconsin, Earl Dahl needs and recognizes the best in executive aircraft radio equipment. As countless other experienced flyers have been doing for almost two decades, Dahl came to Southwest Airmotive.

Radio panel in Rahr Malting Co. Beech, showing how a considerable amount of equipment has been worked into a relatively small space. Note room for expansion of frequencies on glide path and dual audio utilizing F-11 isolation amplifier. Panel is plug-in type. Pilot Dahl received complete wiring diagram at time of job's completion.

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Trim that Torque

(Continued from page 28)

forces. To assist the pilot in trimming off the effects of forces during other sustained maneuvers, such as long climbs to cruising altitude, heavy airplanes are equipped with cockpit-controlled trim tabs located on the control surface. Most personal-type airplanes, however, have only an elevator tab controllable from the cockpit, thus necessitating use of the rudder and ailerons as "tabs" for trim purposes.

In any discussion of torque and coordination, the old and often misunderstood adage "don't cross the controls" necessarily bears investigation. This saying has come down through aviation history as one of flying's Ten Commandments. But through little or no understanding of its *true* meaning, it has in effect probably done more harm than good. Undoubtedly, a vast amount of the poor coordination displayed by student pilots is the result of mechanically following this phrase without pause for proper interpretation. Most students believe that reference is made to a "crossed" position of the cockpit controls, *i.e.*, right rudder and left stick, or vice-versa. What is actually meant, however, is an uncoordinated condition resulting from improper control use (regardless of control position) wherein the airplane is *unintentionally* slipped or skidded! There is *no* blanket rule covering control positions in the cockpit that will guarantee good or bad coordination. Instead, conscious thought should be directed toward controlling the airplane in the desired manner without regard to control "position". The same is true of driving an automobile. When first learning to drive, a person is conscious that rotation of the steering wheel to the left results in the car turning left. Later on, with experience and habit formation, the driver turns the car with no conscious thought of the intermediate steering-wheel stage. This is also true of flying. When asked about control position, most highly experienced pilots (who don't happen to have experience as flight instructors) will usually have to back-track and analyze a particular maneuver a few minutes before being able to state the location of the controls for a given moment of the maneuver. In other words, these pilots fly without conscious thought of the intermediate control stage. The student pilot would be wise, too, to think of "flying the airplane" and to forget the phrase "don't cross the controls". The reasoning behind this is apparent from the following, which demonstrates the various and sometimes seemingly unorthodox control positions required for proper coordination in maneuvers similar to each other except for differences in power and speed conditions.

In a straight-ahead climb, for example, torque and slipstream forces to tend to turn and roll the airplane to the left. (British aircraft with counter-clockwise rotating propellers will turn and roll to the right.) The proper way to overcome this effect is by use of sufficient right rudder and stick pressure to assure a coordinated "ball-in-the-center" straight course. This is called "trimming the controls," although no actual trim tabs are necessarily used. As has been demonstrated during flight tests, many students *incorrectly* attempt to control torque and slipstream effect by application of an excessive amount of right stick and *no* rudder. This procedure, although partially successful in counteracting the turning and rolling tendency through high aileron drag, is both dangerous and inefficient because it produces unintentional skids and reduced airspeed.

In high-speed, power-*off* dives and diving turns, the effect of torque and slipstream forces is reversed. As torque force is practically eliminated during power-off flight, the additional engineered torque-compensating lift of the left wing has full sway and tends to roll the airplane to the right. Too, due to the diminished slipstream force, the offset vertical fin tends to turn the airplane to the right. Therefore, to execute a coordinated highspeed, power-off dive in a straight line, it is necessary to use left rudder and left stick. The amount of pressure and displacement required is, of course, determined by many factors such as speed, air density, type of aircraft and so on.

Execution of a climbing turn (climb power) to the right first requires application of sufficient stick pressure to the right to increase lift on the outer or left wing and to decrease it on the right wing. Part of this control pressure is used to overcome torque effect. The resulting unbalanced lift force over the entire span causes the wing to bank. At the same time, right rudder pressure is required to counteract not only the extra drag of the left wing (induced by the extra lift) but also slipstream forces which tend to prevent the airplane turning to the right. As the desired angle of bank is obtained, lift over the entire span is momentarily equalized by release of right stick pressure. At this instant, two forces—torque and lift—tend to cancel out each other but the predominate one then has to be trimmed off by proper stick pressure. Torque tends to decrease the bank. The additional lift of the left wing tends to increase the bank. This other extra lift is generated by virtue of the fact that the left wing, being on the outside of the turn in this case, produces more lift than the inner, right wing. In most shallow climbing turns to the right, the added lift of the left wing will overcome the force of torque and overbanking will result unless checked by use of sufficient *left*, or outside, stick pressure. As all the forces are finally balanced out, an analysis of control "location" will show that *right* rudder and *left* stick are required to executed a coordinated climbing turn to the right! However, if airspeed is reduced below normal and power is increased, torque will probably overcome the additional lift of the outer wing thereby necessitating the use of *right* instead of left stick. Continued use of right rudder to control slipstream effect is necessary, of course, in either case.

Similarly, because of these prevailing forces, a normal power-on climbing turn to the left will require use of right rudder and right stick, once the desired angle of bank

June 1950

	Complete Aircraft			Manufacturer's Net Billing Price		
	Shipments			Shipments		
	TOTAL Jan-Jun	June	May	TOTAL Jan-Jun	June	May
				(thousands of dollars)		
Aeronca						
Champion 85 hp	22	--	2			
Champion 90 hp	37	4	5			
Superchief 85	8	--	1	230	27	48
Sedan	30	7	9			
7CCM[a]	2	1	1			
Beech						
Bonanza	216	52	40			
D-18	11	3	1	2,769	704	449
Bellanca						
Cruisair	2	--	N.A.			
Cruisemaster	13	6	N.A.	117	57	N.A.
Call Air - Call Air	5	1	1	25	5	5
Cessna						
140A	180	25	36			
170A	303	47	72	2,583	424	503
190	18	5	1			
195	51	11	9			
Emigh-Trojan - A-2	13[b]	N.A.	3	35[b]	N.A.	8
Engineering & Research						
G	9	3	2	29	10	6
Mooney - M-18	29	11	9	45	15	15
Piper						
Cub Special	2	1	--			
Vagabond	1	--	--			
Clipper	8	1	1	1,868	380	391
Tandem Trainer	205	57	52			
Pacer	362	75	81			
Stinson	73	--	--			
Ryan - Navion	100	35	27	964	351	145
Taylorcraft						
Sportsman	15	5	4	30	10	8
Texas Engineering						
Swift	15	1	1	70	4	17
T-35[a]	1	--	1			
TOTAL	1,731	351	359	8,765	1,987	1,702

a/ Military type aircraft sold to other than U.S. Military Customers.
b/ 5 months only N.A. Not available.

AIA REPORT on personal and executive aircraft shipments by 11 manufacturers

Kaman Explorer

A new-type helicopter designed and built by Kaman Aircraft Corporation, Windsor Locks, Conn., the *Explorer* is a cabin model 'copter designed primarily for aerial survey work and personnel and cargo transportation. The first *Explorer* off the production lines at Kaman's factory was purchased by the Mississippi Geological Survey Commission. The 'copter is powered by 225-hp Lycoming engine, and carries a pilot, two passengers, plus cargo. Maximum visibility for aerial surveying is achieved by the extensive use of transparent plastic in cabin construction. Dual controls permit pilot to fly from front or rear seat.

and rate of turn has been achieved—right rudder to prevent the airplane skidding to the left due to slipstream effect and right stick to overcome the combined forces of torque and added lift of the outer (right) wing.

Again, as in power-off dives, there is a reversal of torque and slipstream effect in diving turns. A high-speed power-off turn to the left requires (after the desired angle of bank is obtained) left rudder and left *or* right stick pressures depending on whether the additional lift of the outer (right) wing overcomes the "unused" torque-compensating lift of the left wing, or vice-versa. A power-off diving turn to the *right* will require *left* rudder and left stick. Left stick, because the torque-compensating lift of the left wing is combined with the additional lift caused by this same wing being on the outside of the turn.

Listing these maneuvers in pairs clearly sums up the differences in control "location" relative to the cockpit.

Straight climb:
Power-on—Right rudder, right stick.
Straight dive:
Power-off—Left rudder, left stick.

Right climbing turn:
Power-on—Right rudder, *left* or right stick.
Right diving turn:
Power-off—*Left* rudder, left stick.

Left climbing turn:
Power-on—*Right* rudder, *right* stick.
Left diving turn:
Power-off—Left rudder, left *or* right stick.

Although control use is described here in terms of cockpit location, it is done so only for the purpose of demonstrating, on paper, the fact that *no* hard and fast rule will guarantee coordination under all phases and conditions of flight. This can be more easily and positively proved in flight by reference to a ball-bank indicator. If the ball is centered, then torque and/or other forces are being *trimmed* correctly. If the ball is off center, it's an indication of skid or slip, regardless of control position. If such a condition prevails unintentionally in most maneuvers, it should point up the need for a change of thinking by the student pilot. A need for more thought concerning simple everyday basic aerodynamics. The need to think in terms of "flying the airplane, ... not the controls". A need to trim that torque!

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Dilbert

(*Continued from page 33*)

Another pilot got set to land in the first third of the runway. He didn't overshoot or undershoot—he landed on the side of the runway. He missed the first few runway lights, but made up for it by wading through the next 12. With a runway 150 feet wide, how can you score this as anything else but pilot error?

Groundloops are another big cause of landing accidents. Relaxing control, landing in a crab, using brakes excessively, adding too little or too much power are a few of the causes. If you land straight ahead and keep rolling straight ahead, you can't groundloop. Therefore, discounting those groundloops caused by material failure, you won't be far off in tacking a big "pilot error" opposite the rest of them. Often it is when a pilot feels he has a landing in the bag that he gets careless, and winds up holding it.

So long as pilots continue to relax their vigilance, neglect their proficiency, and fail to comply with safety instructions, "pilot error" will continue to receive top billing on the list of accident causes.

Downwind Turns—Dilbert took on a little job of crop dusting. He liked hedgehopping anyhow, and this way he figured he would get paid for his fun, and not be breaking any regs.

The first day nothing happened, except that it wasn't as much fun at 4 P.M. as it had been in the morning. The next day it was windy, 25 mph, and it was still less fun.

He landed about 11 A.M. to reload. Shortly after take-off he made a sharp turn downwind at an altitude of 50 feet. He had completed about 130° of the turn when the airplane, despite frantic horsing back on the controls, spiraled into the ground. When Dilbert hobbled away from the pile, he had lost all interest in crop dusting

Dilbert was very helpful to the CAB inspectors as they attempted to determine the cause of the accident. He insisted the plane and engine were functioning perfectly. "The plane just seemed to fall out from under me." Had he looked at his airspeed meter? No, but he could tell from his groundspeed that he had plenty of flying speed.

After further investigation and due deliberation, the Board decided that the probable cause of this accident was "failure to maintain control of the aircraft during a steeply banked downwind turn near the ground." Strong wind was listed as a factor.

When the official report came out, the board had included some good safety advice:

1. Assuming a uniform wind, there is no difference between turning upwind or downwind, either in practice or in theory.

2. Close to the ground, however, visual reference to the ground may cause a faulty belief of airspeed.

3. This misconception increases with the amount of wind.

Therefore—Maintain airspeed, irrespective of what the ground speed *appears* to be.

Those Homemade Repairs—All those who have tinkered around a "Model A", or its predecessor the "T", raise their right hands. Almost unanimous! Remember the fun you had? Learned a lot, too; took ingenuity to keep 'em running. Got to be wizards with bailing wire, friction tape and glue; anything to hold the old crate together 'til you got home.

Sorry to have to spoil your fun, but that is what's the matter today; too darn many jalopy mechanics have taken up flying, and treat their airplanes *the same way*. As many can testify, it won't work. This is one time that a little knowledge is a dangerous thing.

You can't experiment with an airplane. The penalty for being wrong is too great. Here's one example. A pilot did some work on his engine and asked an aviation engine mechanic to check it. Fine so far, but wait.

The mechanic pointed out that the rocker arms and the rocker arm bolts were worn out and must be replaced. He removed several bolts so the pilot would not try to run the engine until new parts had been put in. But you can't fool an old jalopy man!

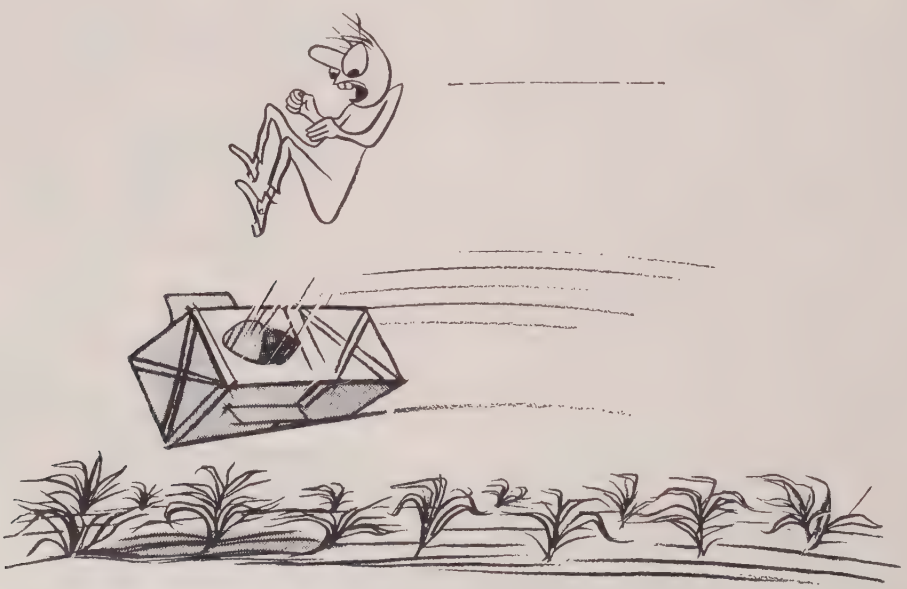
There being no new parts available locally, the pilot decided to save time by having the parts made at a garage. He installed them himself and then decided to test her. He admits he was about 150 rpm short of normal on the ground, but what-the-hell!

He got in the air after an abnormally long run. At about 100 feet, the engine began backfiring through the carburetor and losing power. There was nothing to do but land, which he did—through an apple orchard. Total wreck for the plane and several trees, but thanks to the gradual deceleration, only minor injury to the pilot.

Here's what they found in the engine which our ex-"Model A" engineer had been meching for nine months. The number 5 exhaust rocker arm axle had fallen out and lay in the bottom of the cowling. The tapered lock screw which had retained this axle was found backed out nearly all the way, and not safety wired. Three other rocker arm lock screws could be turned with the fingers and safety wires were not properly applied.

Besides all this, the engine cowl joining bolts and the drain plug were not safetied. The fuel strainer contained a large quantity of coarse grit and was not securely wired.

For the love of Mike, don't louse up your own plane. If you do any work on it and aren't an A & E, get one to check it.



Dilbert's almost-last words: "The plane just seemed to fall out from under me!"

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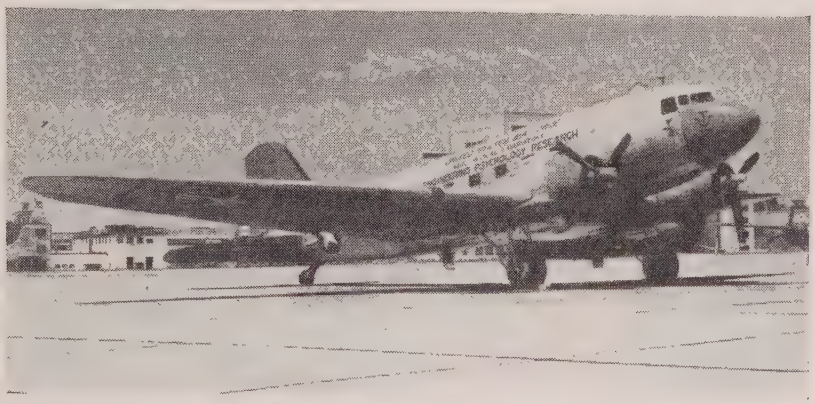
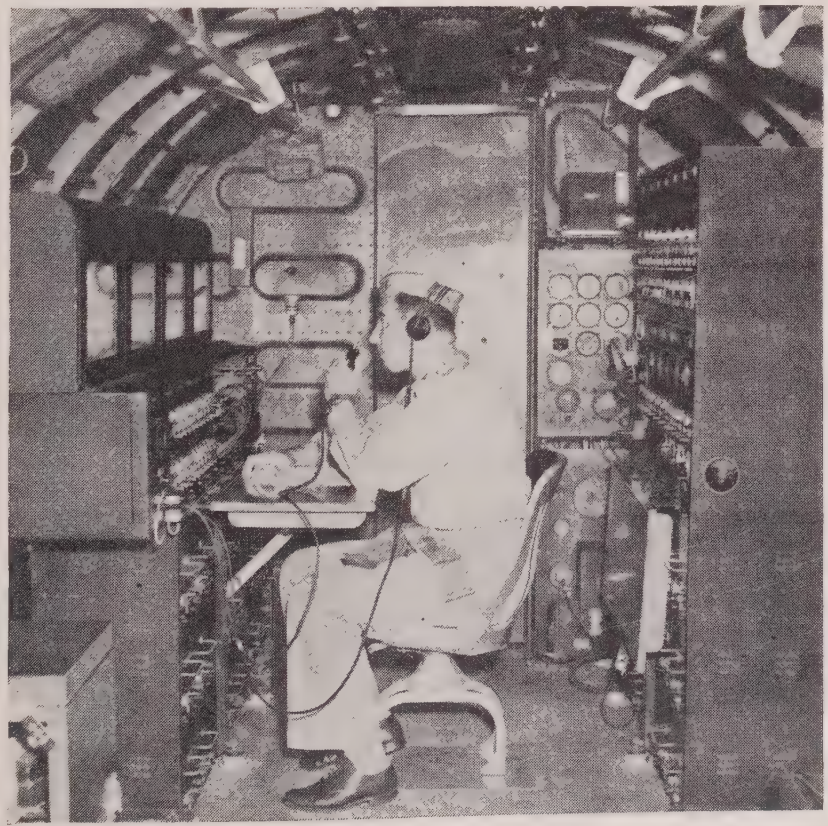


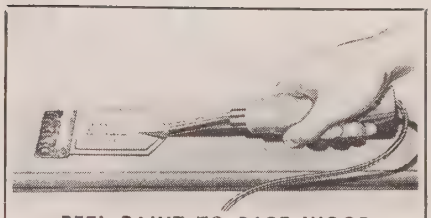
AIRBORNE PSYCHOLOGY LAB is C-47 especially equipped with recording devices

HIGH-SPEED REACTION

ANY autoist can tell you that high speed on the highway calls for quick thinking and split-second action. That goes double when you're at the controls of today's high-speed aircraft. Engineering psychologists are endeavoring to design and develop flight equipment that will permit the human operator to function as efficiently and as safely as possible. To do this, the Aero-Medical Laboratory at Wright-Patterson AFB is using an Airborne Psychology laboratory to determine just how a pilot reacts to certain problems during flight. This lab is a C-47 equipped with special electronic scoring devices which record how accurately pilots are able to maintain heading, altitude, airspeed and the many other variables of flying. A voice recorder and motion picture camera record the pilot's comments and his eye and body movements during the tests in the airborne laboratory. Increased speed and instrument complexity of future planes will mean the pilot of tomorrow is going to have a rough time of it, but the data secured with Airborne Psychology laboratory will go a long way toward helping the pilot do a better job.

INSTRUMENTS in the "Flying Lab" check every reaction of pilot in the cockpit





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HANGAR FLYING

Silvaire Wing-Flap Kit

The Luscombe Airplane Corporation recently announced a wing-flap kit suitable for installation in all-metal wing *Silvaires*. This new kit improves the performance of the *Silvaire* in short-field operations and increases safety in all operations. With these new flaps, the *Silvaire* offers a 35-mph power-on stall, can climb out of a field over a 50-foot obstacle in 600 feet or less, and can land over a 50-foot obstacle in 450 feet or less. These figures are based on full gross weight of 1400 pounds. Price of the new flap kit is $300.

Rules of Thumb

The publication of the Illinois Department of Aeronautics, *Illinois Aviation*, rings up two rules of thumb for pilots to remember if they want to grow to be old pilots. Says Illinois Aviation, "Unless you are a thoroughly proficient instrument pilot and are flying an IFR-equipped plane, and unless you feel that you must push on, bear in mind the following:

1. If the amount of drift correction necessary to make your true course progressively become less, you are running into weather that's getting worse.

2. In approaching a storm, if your drift correction is to the left, go left around the storm and vice versa, to avoid the frontal area of worse turbulence. Better yet, execute forthwith the 'Rule of the 180' . . . and get hangared or tied-down."

Landing Area Vehicles

Flight Safety Foundation calls attention to the recent CAA Technical Order Number N4 which requires all vehicles used on landing areas of an airport to be painted chrome yellow. Vehicles not ordinarily used on landing areas, runways, taxiways or peripheral roads must be identified by a flag flying above the vehicle whenever it travels over any part of the landing area. This flag must not be less than three feet square and of a checkered international orange and white pattern. For night operations reflector buttons should be prominent on airport landing area cars. Following these suggestions will add safety to all airport ground operations and save many an "argument" between aircraft and motor vehicle.

Float Approval

The CAA has approved Edo Model 1400 floats for use on the Cessna 120, 140 and 140-A. This Model 1400 float displaces 1400 pounds and is smaller and lighter than Model 1650 originally approved for Cessna 120 and 140 seaplanes.

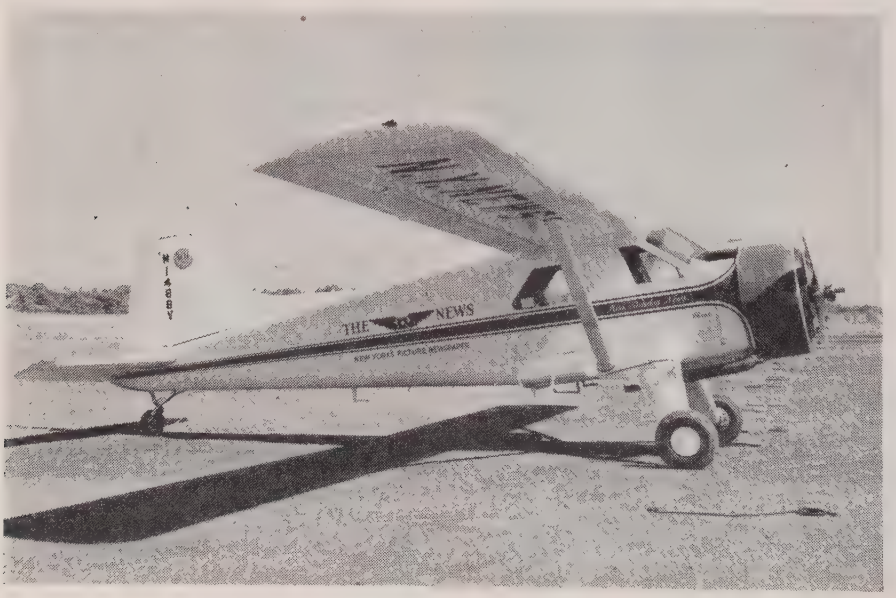
Safety Award

Jerome Lederer, Director of the Flight Safety Foundation, Inc., long has been associated with flight safety investigation. In recognition of Mr. Lederer's work in furthering safety in the air, Mr. Sigmund Janas, President of Colonial Airlines, presented Mr. Lederer with a silver trophy. Presenting the handsome trophy to Mr. Lederer, Mr. Janas stated, "It has long been the custom in the air transport industry for the Nat'l Safety Council to award citations each year to the airlines that have successfully completed the previous year without a single fatality. Too often in awarding this recognition, many individuals who have done their full measure of service in the attaining of the envied objective are not mentioned. . . ." Hence, the award to Mr. Lederer who has worked so long and done so much in the promotion of air safety.

Air Fair

If you are putting together plans for an air show, the CAA's recent booklet should be of help. A 34-page illustrated book, it offers detailed helps in planning and operating an Air Fair as a means of concentrating public attention in the community upon special aviation needs such as an airport, air transport service, etc., instead of the old "thrill-chill-spill" design that attracts spectators who come to see only the daredevil danger aspects of flying. Also included in the Air Fair booklet are suggestions for getting sponsors, financing, choosing committees, etc. This booklet is available from the Supt. of Documents, Govt. Printing Office, Washington 25, D. C. Cost—20 cents.

N. Y. DAILY NEWS' new plane, a De Havilland *Beaver*, is used for spot news photography



National Air Races

The National Air Races, usually held over the Labor Day weekend at Cleveland Airport, have been postponed until the weekend of May 19 and 20, 1951, to coincide with Armed Forces Day. This new date was chosen in order to comply with the expressed desire of Defense Secretary Johnson to curtail defense force participation in scattered events throughout the year. This new May date is expected to make possible increased participation by Canadian jet planes which this year are scheduled to be in England in September but which will be free to come to Cleveland next spring. Under the new plan, the Bendix Trophy Race and the Thompson Trophy Race will be confined to jet airplanes. The Continental Trophy Race will be the lightplane event.

Lightplane Anchor

Engineers of the Air Materiel Command and All-American Aviation are experimenting with a gadget that may eventually serve as an anchor for small planes and gliders. A steel tube, 28 inches long and filled with rocket propellant, is inserted into a holder near the tail assembly of the plane. During the landing, just before touching the ground, the pilot pushes a button in the cockpit that discharges the rocket propellant in the tube, driving the anchor 18 inches into the ground at a 45° angle. Attached to the anchor is a 200-foot stainless steel ribbon wound on a hydraulic brake that absorbs the energy at the time of the braking action and permits a smooth, easy stop. In tests, an L-13 landing at 75 mph was brought to a halt in 168 feet. Seven hundred feet are normally required. In ground tests the anchor has withstood a pull of 25,000 pounds. There is very little recoil when the rocket is fired, and the ribbon can be used at least 100 times.

Personnel

Jack Keaveny, chief test pilot for Bellanca Aircraft Corp., has been made Director of Sales to succeed Clarence D. Chamberlin.

Watson E. Richards recently was elected Executive Vice President of Atlantic Aviation Corp., Teterboro, N. J.

Howard F. Rough has been named Civil Aviation Adviser at Paris under a joint arrangement of Dept. of State and CAA.

Harris F. Reeve has been appointed Safety Research Editor of Flight Safety Foundation. Mr. Reeve formerly was Managing Editor of Aeronautical Engineering Review.

J. V. Naish was elected vice president-contracts for Consolidated Vultee Corporation. Mr. Naish joined the company in 1949 as corporate director of contracts and manager of contracts for the San Diego Division.

Operation Cattle Lift

(*Continued from page 27*)

vert the C-54's to "cattle planes." His crew fabricated stalls that could be slapped into place as fast as the animals were loaded, to keep the cattle away from the sides of the planes and prevent jostling in flight. Double-thick canvas bags were slung below the reinforced floors to catch the waste and protect the planes' bellies from corrosion. For the sheep, goats, pigs and dogs Goldberg devised a double deck, the upper deck put in place after the lower-deck animals were loaded. Even with these changes and allowing for extra fuel, the C-54's were able to carry 17,000 pounds of livestock per trip—about 20 cows or horses, or 130 pigs or sheep—on long, nonstop flights, 1400 miles Des Moines to Miami, 1100 miles Miami to Barranquilla.

Al Goldberg thought of everything—except the windows. The animals were loaded easily, were drowsy and quiet aloft, but when the first plane landed in hot, humid Barranquilla, cows and bulls bawled, pigs squealed, sheep bleated; they were slowly suffocating—and the stench was terrible. Pilots hastily knocked out the windows, and after that, despite the cold of the northern airports, Operation Cattle Lift flew with open portholes. In the flights to date, only one animal has been lost—a bull that died from the heat in Barranquilla while officials were unwinding the yards of red tape involved in flight clearance.

Operation Cattle Lift hit no snags until on one flight a local official at Barranquilla found some of the shipping papers missing. He decided to shoot the entire planeload of cattle. Capt. Lucien Le Clere and co-pilot Bill Pattis stretched their high-school Spanish to e limit, and managed to save their $50,0 cargo by flying it over the mountains to Bogota, where more appreciative farmers were waiting at the airport.

The cattle lift calls for careful planning and adroit timing all along the line. Farmers deliver the livestock at the Des Moines or Toronto or other embarkation airports for early-morning loading, enabling the plane to reach Miami before dark, when the U.S. Agricultural inspection service closes for the day. Flights out of Miami are at night, timed to arrive by early morning in Colombia, where daily afternoon thunderheads make flying over the mountains hazardous. From Barranquilla the planes are cleared early to Bogota, Medellin, or Cali, where the livestock is unloaded in time for the Tigers to wing back to Miami that night.

After the first few flights the Tigers cut the trip from the East and Midwest—Newark, Des Moines, Milwaukee or Houston—to Bogota down to two hops, stopping only at Miami for fuel and clearance.

Operation Cattle Lift has proved that air transport holds revolutionary possibilities for the interior valleys of South America, which are lush and livable but so isolated that they can be reached only by air or pack mule. The Colombian Department of Agriculture offers the animals and fowls flown in by the Tigers to enterprising farmers at cost. The money goes back into a revolving fund to buy more livestock. Thus the 35 planeloads of stock the Flying Tigers contracted to deliver will in time grow into many more flights and have a far-reaching effect on Colombian agriculture.

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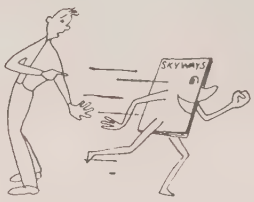

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'46 CHAMP, 211 hrs. since major, licensed to Sept. '51. $750: AIRMART AIRCRAFT, Suite 900, 22 W. Madison St., Chicago 2, Ill.

'49 SEDAN, Bendix Rec. & Trans. 84 hrs. total, never damaged. $3,140. AIRMART AIRCRAFT, Suite 900, 22 West Madison St,. Chicago 2, Ill.

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D-18-S TWINS: 6 available. October 1947 Executive, #23DS, has hydromatics. Low time. Nose tank. Special soundproofing, instruments and radio. Will relicense. $32,000. Apply, POWERS & GEORGE, Aircraft Brokers, 475 Fifth Avenue, New York City; or, 505 North Ervay, Dallas, Texas; or, 649 South Olive, Los Angeles, California.

BONANZAS: 27 from $5850. 1948 model A-35, #713BS, has 315 hours. Engine 250 hours. Auxiliary tank. Full blind instruments. Omni-range. Excellent. $8,000. Make offer. Inquire, POWERS & GEORGE, Aircraft Brokers, 475 Fifth Avenue, New York City; or, 505 North Ervay, Dallas, Texas; or, 649 South Olive, Los Angeles, California.

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'41 CRUISER, Cont. Engine, just completely recovered, 80 hrs. since major. $850. AIRMART AIRCRAFT, 22 W. Madison St., Chicago 2, Ill.

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'50, PA-18, flaps, never damaged, like new, 38 hrs. total. $2,640. AIRMART AIRCRAFT, 22 W. Madison, Suite 900, Chicago 2, Ill.

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(*Continued on page 56*)

CLASSIFIED ADVERTISING

(*Continued from page 55*)

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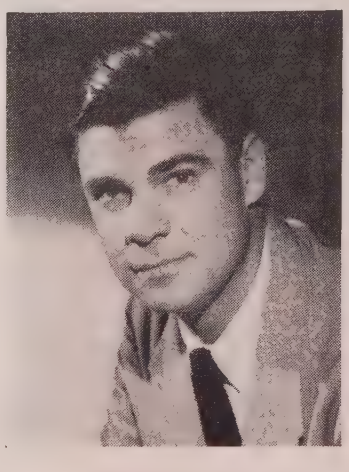
Airmen's Quiz



BERT PARKS, m.c. of NBC's Wednesday evening "Break the Bank" radio and television programs, made a return visit to SKYWAYS' office to toss a "Break-the-Banker" at us. So . . . gather up a pencil and take off for a try at these questions. Score yourself 10 for each right answer. If you're in the 80 to 100 bracket, you're okay. If you miss a couple and glide into the 60 or 70 bracket, you're probably still okay but just need a little check time with the books. If you undershoot and come in under 60, watch out!

1. If your engine cuts out during take-off, turn back to the field as quickly as possible.
   ☐ Right ☐ Wrong
2. In taking off crosswind, lift the tail as quickly as possible and, on nearing flight speed, exert slight pressure on the stick toward windward side.
   ☐ Right ☐ Wrong
3. When flaps are used, lift is increased by a decrease in camber.
   ☐ Right ☐ Wrong
4. A flashing red light means to clear the landing area.
   ☐ Right ☐ Wrong
5. An afterburner on a jet engine increases the thrust of that engine.
   ☐ Right ☐ Wrong
6. Ground checking of mags should be made with prop pitch control in low pitch for constant-speed props.
   ☐ Right ☐ Wrong
7. If cleared on VFR flight plan and the flight is completed without incident, it is not necessary to file notification of arrival.
   ☐ Right ☐ Wrong
8. When pulling a prop through by hand prior to starting the engine, the prop should be rotated in direction opposite that of normal rotation.
   ☐ Right ☐ Wrong
9. Pulling prop through by hand prior to starting engine clears oil from intake pipes.
   ☐ Right ☐ Wrong
10. When gliding in for a landing, pilot should periodically open and close throttle.
    ☐ Right ☐ Wrong

ANSWERS TO AIRMEN'S QUIZ

1. WRONG! A pilot should never turn back to the field in case of engine failure on take-off. Land straight ahead.
2. Right.
3. Wrong. Lift is increased by *increase* in camber.
4. Right.
5. Right.
6. Wrong. It's low pitch for two-position and variable-pitch props; take-off rpm for constant-speed props.
7. Wrong. If a flight plan has been filed, always file an arrival notice.
8. Wrong. Always in direction of normal rotation.
9. Right.
10. Right. This will keep engine from "loading" up.

Omni and ILS demonstrated in Bonanza during flight over New Jersey and Pa. . . . . Page 59

NAVICOM

NAVIGATION, COMMUNICATION

ARC's Omni-ILS Indicator

Pilot discusses the case for VHF transmitter and LF receiver as plane radio package . . page 62

Edited by Col. N. F. Silsbee

AIR FORCE JOBS

And How They Lead to CAREER OPPORTUNITIES In the Air Force and in Civilian Life

Airmen are select men—selected for intelligence, and for high moral and physical qualifications.

Airmen are select men in another way too—they are selected for Air Force careers on the basis of their individual aptitudes.

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AIR FORCE CAREER FIELDS
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Airmen are Select men!

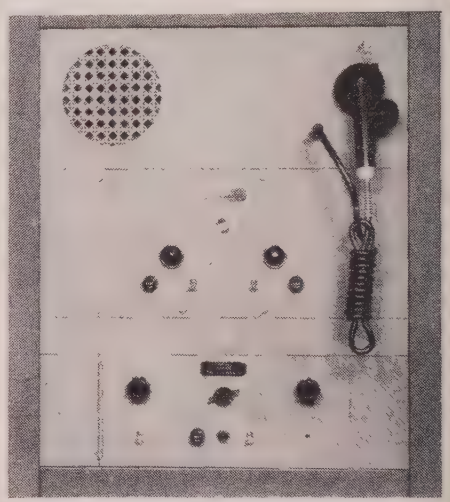
U. S. AIR FORCE

RECRUITING U.S. ARMY U.S. AIR FORCE

TEL-AIR Radiophone Developed for Private Airports

Schuttig and Company, Inc. of Washington, D. C. has just announced a new airport radio-telephone set designed and constructed specifically for the use of the private-airport operator. The set has a transmitter power output of 10 watts and a receiver sensitivity of one microvolt. The design and workmanship are substantially the same as Schuttig has supplied to the CAA for many years.

Included in its features are the ability to operate continuously, optional remote control and extreme simplicity of operation. Only an FCC operator's permit is required, there being no license examination necessary.



TEL-AIR operates on the 122.8 mc frequency for private pilots which has recently been approved by the RTCA, whose Special Committee 56 reported that this was the only one available for the purpose. It is expected that the FCC will have cleared this frequency for general usage by September 1, 1950.

TEL-AIR opens a new field of activity for the private airport because it makes available the highly important tool of reliable communications. Private pilots will welcome this extension of the practical utility of their aircraft.

The price of the TEL-AIR set ready for installation, including all parts, is $475.00 f.o.b Washington, D. C.

GCA's Chalk Up "Saves"

CAA personnel report that the five improved civil-type Gilfillan GCA sets now in operation at Chicago, Los Angeles, LaGuardia, Cleveland and Atlanta chalked up several dramatic emergency "saves" during their first weeks of operation.

The operators at the Los Angeles tower report that the surveillance radar unit is paying for itself over and over again just in the "missed approaches" it is able to prevent.

NAVICOM

Omnirange, ILS Demonstrated

Trial flight proves utility and simplicity in operation of A.R.C.'s radio-packaged Beech *Bonanza*

By Col. N. F. Silsbee

After reading and writing about the advantages of VHF and how omnirange takes the headaches out of navigation, your reporter decided to try it for himself.

According to plan, I met Al Parkes and H. S. Christensen of Aircraft Radio Corporation, Boonton, N. J., at Atlantic Aviation's hangar at the Teterboro Air Terminal.

Bonanza Panel ▶ Settling into the co-pilot's seat of the A.R.C. *Bonanza,* we found it really contained the works—radio-wise. First was the A.R.C. Type 17 two-way VHF communication system which consisted of transmitter with five crystal-controlled frequencies and continuously tunable receiver. To back this up in the low frequency bracket there was the Type 11A Range Receiver, with rotatable loop, in the 190-550 kc bracket, which includes all CAA and Army-Navy LF radio ranges. And finally, the Type 15B VHF Navigational Receiving Equipment, including omni, ILS, GCA voice reception, and VHF voice signals from airways stations and control towers. All these sets are remotely controlled, with a nicely integrated and conveniently located set of switches and dials.

Equipment Cost ▶ Asked about total weight and cost of this equipment, Christensen reported it weighed about 60 pounds and cost about $3,400. He explained that every piece of the equipment had been type certificated by the CAA, making it suitable for airline use, but that it was lighter and less expensive than comparable sets.

He went on to say that the combination in the A.R.C. *Bonanza* provided a basic package of up-to-date radio navigational and communications equipment for any four-place (or more) aircraft. He also claimed that the increased cost over the lower priced lightweight sets was justified by the higher precision built into A.R.C. stuff, the drastic tests and inspection procedures used, and the high quality installation which includes moisture-proof sealing, etc. All this spells a high degree of reliability, and long span of operational service between maintenance checks—a saving of hundreds of dollars in the long run.

Flight Demonstration ▶ We took off and climbed to 3,000 feet. To demonstrate the ability of the Type 15B set to provide a fix if you are not sure where you are (and that can happen!), Chris said, "Well, here we are somewhere over northeastern Jersey in the general vicinity of New York—we hope! Our chart shows us that we can pick up the Caldwell VOR station by tuning 115.5 mc on the Control Unit. So we do that.

"Owing to certain terrain features, it's not one of the best stations, but you ought to be getting its signal in your headphones within a few seconds.

"Sure enough, we began to get the Caldwell 'beep' just as he finished talking.

"Now we want to know where we are in relation to the Caldwell omni. To find out, we just turn the knob on the Course Selector until the swinging vertical or track needle of the Cross Pointer meter is centered. There it is now—at 260°. Thus, we know we are located east of Caldwell omni because the To-From indicator is pointing up at 'To,' and the bearing of 260° is almost due west.

"Now all we have to do is to turn the airplane until our magnetic compass shows a heading of about 260° and fly a straight course. That little circle in the center of the Cross Pointer dial represents the plane, and the vertical needle is your own radio 'beam.' As we swing around from our present heading to 260°, notice how the needle comes into place on your track to Caldwell VOR. You always turn the plane *towards* the needle to get it to come towards the circle in the center.

"Now we'll fly along a bit, and we don't need to keep the needle at dead center. We only have to fly the trend of the needle and an approximate heading will do. It is easy to over-correct and keep swerving to the right and then to the left if you try to keep the needle strictly on center.

"The usual explanation of VOR is to compare it with a wheel with 360 spokes, one for each degree. There's nothing wrong with that idea, but I like to think of it as a single track which you can put in any direction you want with your Course Selector and then fly that track by using your Cross Pointer meter. That fits the name 'Omnidirectional' just as well as the other idea.

"It will take us a little off a direct course to Boonton, but I want you to see just what happens when we fly over a VOR station. It won't be long now. . . . Here we are, getting pretty close, and there it is in that field down there. Now notice the 'To-From' needle begin to wobble, and that the signal gets louder and the indicator's amber light flashes. There! we've passed over it and now we are heading *from* Caldwell. (I glanced at the indicator which now pointed down to 'From.') This is a lot simpler and more accurate than trying to locate by ear the exact time of passing over an old four-course LF range station.

"Boonton is on a 290° bearing from Caldwell omni, so we swing a few degrees north and we'll be over the plant in a few minutes."

And so we were, right among the hills of northern New Jersey, with Boonton Lake to the south.

For another go at orientation, we climbed to 2500 feet and found ourselves "lost" again. This time we tried a slightly different method of getting our bearings. With the 15B control function switch still on OMNI, Chris turned the tuning knob slowly, and soon we began to hear (faintly) the ABL or Allentown VOR signal (117.5 mc), over 60 miles away. Within another minute it was coming loud and clear, and Chris began to turn the Course Selector, watching the track needle on the Cross Pointer meter for signs of life. We were flying an arbitrary heading of 270° and it could have been *any* heading as all we were trying to do at this point was to intersect the Allentown VOR track. Nothing happened to the track needle at first, then suddenly it began to swing toward the center. Continuing to turn the Course Selector slowly, Chris finally got the track needle to center with the Course Selector needle indicating 230°. The To-From dial said "To," so we knew we were northeast of Allentown omni.

Christensen then pointed out that VOR tells you your position *relative* to an omni station, but does not give you the *heading* you are flying. To illustrate this, we proceeded to make a sweeping 360° turn, with the track needle holding dead center all the way.

Swinging from 270° to the required 230° heading, we were on our way toward (*Continued on page 64*)

Custom-Tailored Radio Installations for Executive Aircraft Afford Extra Benefits in Plane Operation

A firm conviction that private airplane radio systems should be planned rather than be permitted to "just grow like Topsy" is keynoting current successes of the Southwest Airmotive Company radio shop at Love Field, Dallas.

As exemplified in a number of major installations in executive aircraft, and as supported by an increasing circle of enthusiastic flyers, the SAC "planned radio" idea very definitely has caught on. It calls for the executive pilot to come in with his problems—and with an open mind—and to work in cooperation with Southwest Airmotive personnel in starting from "scratch" to plan an installation custom-tailored to the individual's flying needs.

This way of doing things does not preclude the re-use of gear which already may be in the airplane. Throughout the planning, efforts are made to work such equipment as ADF and marker beacons back into the picture again.

Exec Radio Problems ▶ The executive flyer's radio troubles began multiplying after the war when owners acquired big aircraft already equipped with a variety of military communications gear. Then, as new postwar developments made their appearance, these were added to form what has become a regular "crazy quilt" of radio equipment. Result: Many executive planes are overloaded radio-wise; wiring problems are multiplied; and equipment is often inefficient, awkwardly located, and difficult to operate.

SAC contends that the initial cost of a re-designed radio system will be offset in time by the extra benefits it affords—*i.e.*, less maintenance, less weight, greater versatility, dependability, and ease of operation.

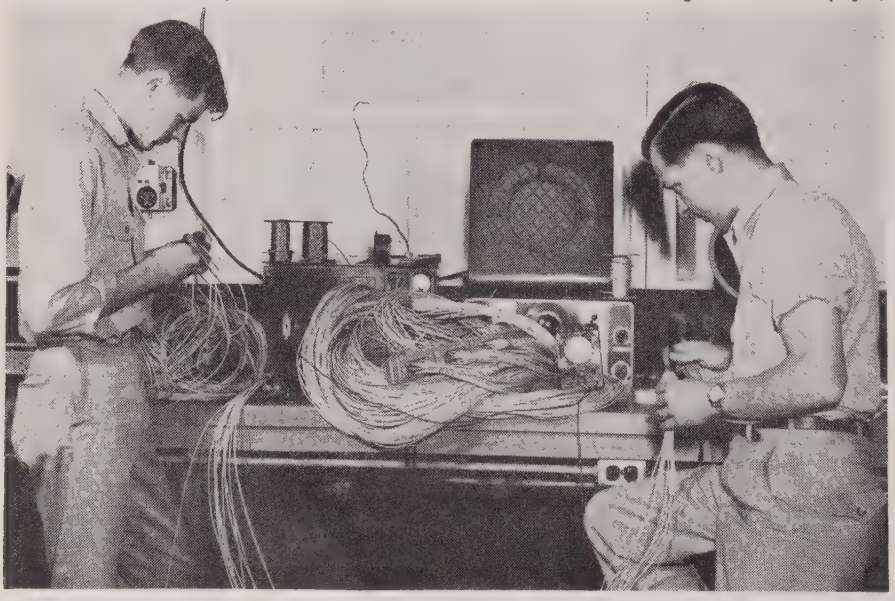
Planned Radio ▶ Among the features of Southwest Airmotive's postwar radio jobs for executive aircraft are plug-in panels (which the airlines long ago found saved many hours in maintenance), allowance for future expansion in such equipment as VHF transmitters and receivers and in marker beacons, and the furnishing of a complete wiring diagram at the time the job is finished. The wiring prints become the pilot's permanent property, while the original drawings and another set of prints are retained in SAC's radio shop files.

SAC Facilities ▶ To equip itself for such exhaustive assignments as the designing, fabricating, and installing of complete systems in executive *Lodestars* and Twin Beeches, SAC has the services of one of private aviation's best known radiomen and a shop filled with the finest tools and equipment. Shop Boss George Handwork came to SAC a year ago from Atlantic Aviation. He previously had been associated with the Aeronautical Radio Company, Roosevelt Field, Long Island; Lear (who sent him to Beech "on loan" for two years); and with Cessna where he was in charge of radio installation and flight test. During the war, he worked on Naval Aviation projects for Philco. Mr. Handwork is credited with several of the first executive *Lodestar* installations and with many of the first Class-A installations in twin-engine Beeches.

At Southwest Airmotive, Handwork and his crew are assured of interference-free testing through use of a scientifically devised screen room, and through up-to-date checking apparatus for ADF, omni, marker beacons, glide path and localizer, etc. All radio work is performed strictly according to schedule, and one of the attractions is the fact that SAC's 18-year-old "one stop" service base permits aircraft, engine, accessory, propeller, and instrument jobs to be conducted simultaneously with the radio assignment. The "one stop" feature has been a particular asset because it saves time for the plane owner and eliminates the need of the pilot shopping about from airport to airport to get the complete maintenance task accomplished.

SAC is an authorized representative of ARC, Collins, and RCA, and each of these manufacturers has worked closely with Southwest in developing sales and maintenance approaches. Factory personnel frequently is on the scene at Dallas. As an example, executive pilots in the area in mid-July saw RCA's latest equipment as demonstrated in a Twin Beech flown to Southwest Airmotive from the plant at Camden, N. J.

FACILITIES at Southwest Airmotive are geared to "planned-radio" design problems of executive aircraft. Shop boss for SAC is well-known radioman George Handwork *(right)*



Beacons Out

According to the Air Traffic Control and Navigation Panel, the CAA's program of marking hazards and airports with beacon lights shall be continued.

The program of maintaining existing airway beacon lights (which define a point on an airway in mountainous terrain) shall be continued, except that airway beacon lights may be eliminated in *flat areas* of such mountainous terrain if safety requirements permit.

The program of maintaining existing airway beacon lights upon which individual air carrier operations are predicted shall be continued, subject to continuous evaluation.

Beacons Discontinued ▶ All airway beacon lights not serving the above purposes shall be discontinued except where required for safety considerations.

The following beacon sites were discontinued on July 31st, all in Region One; others will be announced later. ATL-LGA: Blackstone, Va., Riverdale, Md., Glenburnie, Md. BNA-DCA: Pine Ridge, Va., Dublin, Va. BUF-LGA: Castile, N. Y. CHI-LGA: Clarksville, Clintonville, Knox, Reynoldsville, Clearfield, Millheim, all in Pa. CLE-ALB: Ebenezer, Akron, Batavia, Chili, Fairport, Fayetteville, Little Falls, Auriesville, all in N. Y. CMH-PHL: Coatesville, Pa. DCA-CLE: Moon Run, Pa., Clinton, Pa. LGA-BOS: New Haven, Conn., Cromwell, Conn., Wellesley Hills, Mass.

In order that the discontinued airway beacon lights might be used to the best advantage by pilots flying aircraft not equipped with electronic navigation devices, it is proposed that they be disposed of to local State, County and City Governments and installed at small airports. This should help the average night-flying contact pilot more than the present airway beacons.

Zero Reader for Executive Planes

Pilot tries out Sperry Zero Reader on LG Approach, calls it a "must" for operation

By R. D. Brown, President
Union Cutlery Company, Inc.

Some months ago several articles were written about the Sperry Gyroscope Company's Zero Reader. The description of the instrument in these write-ups was too good to be true, but the thought of being able to make low approaches with the consistent accuracy of an A-12 Gyro-pilot deserved further investigation.

The scope of our company operation requires about 400 hours a year on a Beechcraft D-18S. Most of this time is spent in the east, south, and southwest, with occasional trips to the west coast. I do a great deal of the piloting as I like to fly, and my assistant, H. F. White, also does a considerable amount of piloting.

Twin-Beech Panel ▶ Our Beechcraft is well equipped with both low and very high frequency navigation and communication equipment, a Bendix ADF, Bendix 75-Watt 3105 kc transmitter and two low frequency range receivers, a Colonial ARC-3 transreceiver, two A.R.C. VHF transmitters, an A.R.C. VHF communication receiver, an A.R.C. Omni, and localizer receiver, and a surplus Glide Slope receiver.

Although this equipment should be adequate for CAA minimums, we felt that the lack of opportunity to make a number of low approaches at each field we use called for our own set of minimums of 500-foot ceilings and 2 miles visibility. We have no interest in equaling the airlines record for trips completed. During questionable weather our trips can easily be delayed.

Reader Try-out ▶ Our investigation and the subsequent installation of the Zero Reader began shortly after an approach to LaGuardia Field with a reported variable 800-foot ceiling and one and a half mile visibility. The variable part of the weather report must have taken over as we came in, and at 500 feet the runway finally showed up under the wing tip. The second approach was completed, but it was decided that if the problem of low approaches could be simplified by a Zero Reader our safety factor and peace of mind and the utility of our expensive airplane would all be increased.

One demonstration of the Zero Reader in Sperry's C-47 at MacArthur Field convinced us that the hard-to-believe stories we'd heard were not only true but were, in fact, understatements. After the installation of the Reader in our Beech, and some practice in its operation, we made another approach to LaGuardia with minimum conditions in heavy rain. The end of the runway was dead ahead and we were right in the middle for a perfect approach. All we did was "keep it zeroed."

We still do not plan to fly marginal weather but it is great comfort to know we can make an approach without sweating it out if the weather unexpectedly becomes worse than forecasted.

Omni Aid ▶ Regardless of weather, the Zero Reader is a great aid in flying omni. There is no bracketing back and forth to keep on a selected track to or from the station. Just keep the Reader zeroed and if you are not on course at the moment, you will be soon. It's amazing to watch the way it brings the ship from an off-course position to a preselected track on the omnirange, all with the greatest of ease on the part of the pilots.

It is our sincere opinion that no executive aircraft can afford to be without a Zero Reader any more than the can afford to be without radio. This is a strong statement but our "Before" and "After" experience has proved to our own satisfaction that our Zero Reader is a "must."

UNION PREXY R. D. Brown, shown here at controls of his company's well-equipped Twin-Beech, tried out the Zero Reader, then reported it better than anticipated

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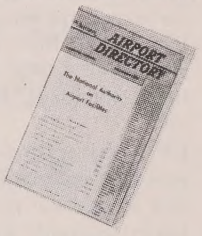

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Lightplane Radio—High, Low

Experienced pilot evaluates VHF and LF under today's radio facility conditions

By Ben Robin

Have recent aviation radio developments confused you? Perhaps you are not certain whether low or high frequency equipment is best suited to your individual needs. You are not alone with your thoughts. Every manufacturer of aviation radios has had to decide whether to build high or low frequency transmitters and receivers for private planes.

R.C.A. has long been a pioneer in radio. They studied the high and low frequency question and came up with an answer. That answer is the "One Sixteen." Would you like to review the problem with me? It will be interesting to see if you agree with the solution.

Pilots and plane owners who install radios do so to increase flight safety. Communication and navigation are the two main functions of aviation radio. The transmitter and receiver are the two integral parts of aviation radio.

VHF transmission ▶ A lightplane transmitter is used for communication only. VHF offers definite advantages over low frequency for transmission. Lower power drain, less static (at ground receiving station), longer range and a simplified antenna system are all possible with a VHF transmitter. Ground, range and tower installation are already equipped for communication on VHF frequencies. R.C.A. had little trouble, therefore, deciding on a VHF transmitter operating in the band of frequencies around 122 mc.

LF Receiver Preferred ▶ The receiver problem included both communication and navigation considerations. It is certainly desirable to use one receiver for both navigation and communication. This is not possible with VHF because the high frequency navigational VOR (visual omni range) is a visual and not an aural aid. The CAA is presently installing omniranges with all possible haste. It is estimated by reliable sources, however, that a period of two more years is required before VOR will be available to private flyers in all parts of the country. The same sources indicate the low frequency (four-course) ranges are to continue operating for a period of five more years.

From the facts already stated two things become immediately apparent. If a pilot buys a VHF receiver for communication purposes, he will find that it will not serve for navigation on either high or low frequencies. If he purchases a low frequency receiver, however, he can be assured of both communication and navigation utility for five years.

It is safe to assume that after five years, more reasonably priced and simplified VHF receivers will become available to private plane owners. The Radio Corporation of America, therefore, decided to go ahead with the "116."

RCA "One Sixteen" ▶ The "One Sixteen," weighing only nine pounds and measuring 4⅝ by 6 by 11 inches, is truly a remarkable piece of equipment. VHF transmitter, low frequency receiver, marker beacon receiver, standard broadcast band, interphone, and loop direction finding are all included.

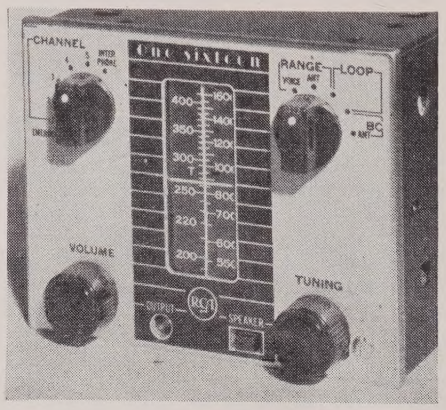
I spoke to Gil Quinby, sales engineer for R.C.A. at Camden, New Jersey, recently and he told me that the one watt VHF transmitter draws less current than a landing light (6.0 amperes).

"I can always depend on a 65-mile range with the "One Sixteen," and I have transmitted up to 140 miles," Mr. Quinby said.

This is greater coverage on one watt of power and a short whip antenna than is normally possible on a 3105 kc transmitter with 10 watts of power.

The transmitter channel switch may be seen at the upper left-hand corner of the "One Sixteen" (*see photo*). Two crystals are provided for 122.1 mc (communication with range station) and 122.5 mc (communication with airport towers). The other switch positions are for additionel frequencies if desired. The 121.5 mc is for emergency transmissions. The 122.7 and 122.9 mc are other frequencies suitable for range and tower communication. A neon glow will be seen in the small output bulb at the bottom of the "One Sixteen" when the transmitter is functioning properly.

ONE-SIXTEEN offers combination VHF and LF for two- and four-place plane owners



The low frequency range receiver tunes from 200 to 400 kc. This receiver features a high signal-to-noise ratio which simply means that so far as modern engineering technique will allow, the range signals are built up while background noise is suppressed.

The most common tower frequency, 278, is clearly marked on the easily read dial of the "One Sixteen." The pilot may listen on earphones or may switch to loud speaker with the switch provided on receiver panel.

The low frequency receiver also covers the standard broadcast band. The pilot may listen to news broadcasts or other entertainment programs by switching (switch on upper right-hand corner) to B.C. A directional loop antenna may be connected to broadcast, range, or tower signals by means of this same switch.

This allows the pilot to home in, directly over the received station, using an aural null. This provides accurate navigation on or off airways and in isolated areas where no range stations are located.

There is no tuning necessary for reception of fan, Z, or other 75 mc marker beacon signals. When the pilot flies over a 75 mc station, the high pitched squeal of the marker beacon is heard over the range or broadcast station, whether tuned in on loop or fixed antenna.

The interphone provides quiet intercommunication between pilot and passenger or two passengers. If you have ever landed, hoarse from shouting above engine noise after a long flight, you can appreciate this feature.

Planes Equipped ▶ The Ryan Aeronautical Company, manufacturers of the *Navion*, have picked the R. C. A. "One Sixteen" as the standard equipment radio for all new *Navions*. Before deciding on this model, they ran exhaustive tests on several models of aviation transceivers. The "One Sixteen," using low frequency receiver and VHF transmitter, proved best by actual in-the-air tests. Another model receiver tested, with higher receiver sensitivity, could not equal the performance of the "One Sixteen" at extreme distances from the ground station. The low signal-to-noise ratio allowed two-way contact with ranges and tower beyond the distances possible with more sensitive receivers.

The R.C.A. "One Sixteen" is an unusual radio because it provides VHF transmitter, range, broadcast, and marker beacon receivers in one small compact unit. The price of $272.50 includes all power supplies and whip antenna. Installation and a loop antenna are extras —$100.00 additional should take care of these two items. This pilot believes the "One Sixteen" is a good answer to the problems of aviation radio for at least the next five years.

TA-18 Announced

Bendix Radio Communications division has announced the TA-18, a multi-channel, crystal-controlled VHF transmitter for aviation service. It may be used for voice communication and, on special order, keyed MCW (modulated continuous wave) transmission.

Frequency range is from 118.0 to 135.9 mc inclusive, providing 180 channels separated by 0.1 mc. It will deliver 25 watts or more power to a 52 ohm resistance load at any frequency within its range. A tuning meter and meter switch are mounted on the front panel to allow checking of the major circuits.

The Transmitter dimensions including mounting base are 9⅝ inches high, 11⅛ inches wide and 22$^{3}/_{16}$ inches deep. Handles on the front panel for easy handling and carrying add 2½ inches to depth. Weight is 43 pounds, less shock-mount.

The TA-18 carries CAA TC 1R3-9, making it suitable for airline and executive aircraft use.

Private Plane VHF Freq.—122.8

Special Committee 56 of the RTCA, after a study of existing VHF frequencies, has allocated 122.8 as a "private pilots" simplex frequency for all private aircraft and airports in areas not ordinarily served by CAA facilities.

This recommendation was subject to the condition that VHF receivers used by private flyers are electrically and mechanically capable of tuning to this frequency, and that marking the dial be within the capabilities of the average individual maintaining such equipment.

The new frequency will permit plane-to-ground, ground-to-plane, and plane communication all on the same frequency. Most existing VHF installations can be modified to transmit on 122.8 mc with very little difficulty other than the insertion of the proper crystal. All tunable omni and VHF receivers can handle 122.8 without further modification.

These sets include the Bendix PATR-10 *Flightphone* RCA-116, Lear, NARCO, ARC, Mitchell *Avigator,* etc.

FCC's rules and regulations on the new frequency are expected to be out by early autumn.

New RCA AVR-21

The RCA AVR-21 Receiver-ADF unit has been designed primarily to meet the needs of commercial, feeder-line and multi-engine executive aircraft, and yet it is light enough for installation in most four-place single-engine planes.

This unit contains many new features not hitherto found in this class of equipment. The mechanical design utilizes to the fullest advantage the miniature components now available, and it results in a complete self-contained unit occupying only one-half standard ATR (air transport receiver) size, and weighs about one-third less (52 pounds, including cabling). With these advantages the very useful Dual ADF operation may be had for very little more weight than existing single installations.

Dual Installation ▶ While many pilots use single ADF operations for both homing and positioning, many executive and airline pilots prefer dual installations which enable the pilot to read bearings simultaneously from any two stations by glancing at the dual indicator (three-inch double-pointer dial), thereby saving considerable time and computation.

AVR-21 Features ▶ The electrical and mechanical design of the AVR-21 conforms to the new RTCA and CAA Type Ctf. requirements. The tuning range includes three bands, 150 to 350 kc; 350 to 800 kc; and 800 to 1750 kc.

Besides the small size and light weight other outstanding features include

(1) Sensitivity—a signal of .7 to 1.5 microvolts to the antenna will provide 50 milliwatts output at six decibels signal-to-noise ratio.

(2) Accuracy—Plus-or-minus one degree accuracy in a field strength of 100 microvolts per meter.

(3) Low Power Drain—Only 3.5 amperes at 26.5 volts input, or 7.1 amperes at 13.25 volts input.

(4) New Drum Dial tuning control with extra long calibration scale.

Price (average installation), $3,200.

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All A.R.C. Airborne equipment is Type Certificated by CAA. It is designed for reliability and performance — not to meet a price. Installations for both single and multi-engined planes are made only by authorized service agencies. Write for further details or name of your nearest A.R.C. representative.

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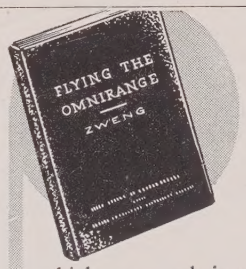

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Omni, ILS Demonstrated

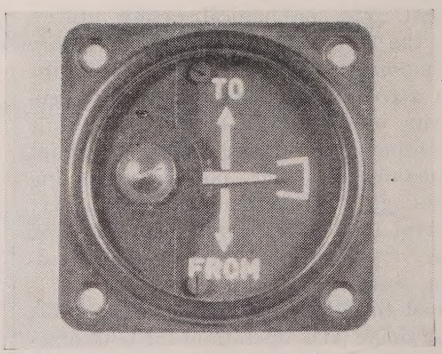
(Continued from page 59)

Allentown VOR. As it was a bit rough we went upstairs to about 10,000 feet, and in quick succession tuned in on VOR stations all over Pennsylvania. This was omni at its best. Admittedly, all the bugs have not yet been eliminated from VHF at low altitudes.

Switching over the control wheel and releasing the pedals on my side, I flew the *Bonanza* while Chris got the Allentown tower on the T-11A VHF transmitter, and asked them to reply on LF, and then on VHF. The VHF reply on the R-15 VHF receiver was clear as crystal, but that over the LF R-11A, while intelligible, was bothersome compared to VHF. This is the communications set-up, leaving the 15B completely free for navigational functions, a highly desirable and, in some cases, practically necessary separation.

Turning back toward Teterboro on a 70° heading, we got set for an ILS approach with the A.R.C. Type 15B Cross-Pointer meter. The Jeppesen Manual gave the complete details for the Teterboro ILS procedure, and about 20 miles out we informed the Teterboro tower of our intention to make a simulated ILS approach.

Switching the Control Unit from OMNI to VAR-LOC so as to pick up the localizer signals (Teterboro is not yet equipped with the new-type Phase Comparison localizer—PH-LOC on the function switch), and keeping the track needle on center, we hit the outer marker of the Teterboro radio range on the nose and the white light flashed on the panel as we passed over it. About four miles further and the amber light flashed for the middle marker. Reaching the vicinity of the airport we passed over the radio range transmitting station, and the needle began a frantic wobbling.



TO-FROM meter shows light, left center

Tuning the receiver to 108.3 mc, the frequency of the Teterboro instrument runway localizer, we made a wide counter-clockwise circle to pick up the final signals. Keeping the vertical localizer needle contered midway between the Blue (left) and Yellow (right) sectors of the indicator, we knew we were flying straight to the runway.

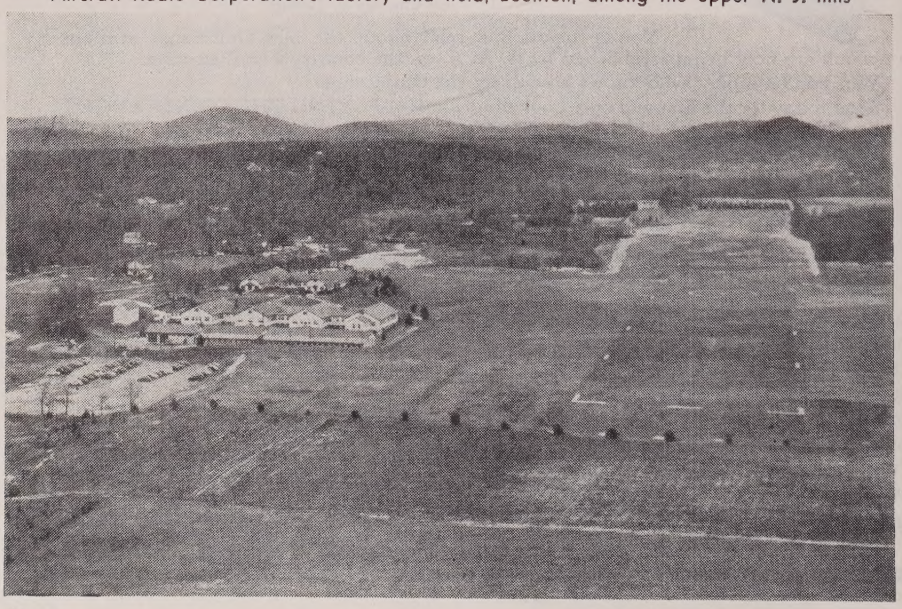
Soon we began to pick up the signals of the Glide Slope, indicated by the horizontal needle. The trick is to fly so that the two needles cross at the center of the dial.

Should the flag OFF show up on either needle, it means that the current is not coming through, or that the system is malfunctioning in some other way.

Just to show how it works Chris flew a bit to the right and then a bit to the left while I watched the vertical needle react, and similarly (above and below) with the horizontal needle. Coming back to dead center we soon landed and were rolling down the middle of the runway.

I had seen this done several times in a DC-3, but it was quite a thrill to experience it in a *Bonanza*—in fact the entire flight with this new stuff going into the transition program was an eye-opener and an experience I shall not soon forget.

Aircraft Radio Corporation's factory and field, Boonton, among the upper N. J. hills



Airborne Radar

The potential users of airborne radar equipment require a series of flexible operational features covering all possible needs. Search, Navigation Aid, Obstacle Detection, Beacon Navigation, Weather Study, Storm Center Detection, and other operations are required.

The Houston AN/APS-42 airborne radar was designed as such a set. Some details of the -42 were reported in September NAVICOM (p.63), but the set has since been classified by the Navy.

Airborne radar operation can be illustrated from the AN/APS-10, of which Donald K. Allison, chief of NDRC's Engineering Office, was a co-designer. It was built by GE for Air Force and used on C-54's. American Airlines gave extensive tests to a gyro-stabilized version (much heavier) in their DC-3 *Alpha* and some cargo DC-4's. An earlier version of Allison's present E series of lightweight radar sets was flight-tested for about 900 hours in a Southwest Airways DC-3 under supervision of Jim Ray.

The pilot turns the knob of a selector switch to "Search" and a continuous map-like picture of the terrain over a radius of 50 miles is "painted" electronically on the PPI scope. Mountains, rivers, lakes, islands, coast lines and cities show up as radar echoes. Naturally, a certain amount of training in scope interpretation is necessary to distinguish these various features.

The set's ability to define heavy clouds and thunderheads when flying at night or on instruments enables pilots to steer clear of turbulent areas.

When the pilot switches to "Beacon," the aircraft's position relative to radar beacons or "racons" is shown. They can be picked up at a distance of 150 miles. "Triggered" or "challenged" by a radio pulse from the airborne radar, these racons (which electronically speaking are transponders) emit a coded signal in the form of pips which show up on the PPI scope and which identify the station. The direction is measured from the center of the pips and the range is measured by means of concentric circles from the pip nearest the center of the scope.

Navy night fighter pilots in radar-equipped *Corsairs* and *Hellcats* (using APS-4 and APS-6 sets) learned how to switch quickly from "Search" to "Beacon" so that the bar pattern transmitted by the carriers would be superimposed on the electronic map before it faded away.

All this has a bearing, not only for postwar military techniques with improved equipment, but also for commercial use as lightweight airborne sets like the Allison, E, ES or ESB become available. One of the Allison sets is now in the hands of the Coast Guard for extensive tests.